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DIFFUSE GASTRIC POLYPOSIS—ADENOPAPILLOMATOSIS GASTRICA

REPORT OF FIVE PROVEN AND SEVEN PROBABLE CASES

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THE great predominance of malignant over benign neoplasms of the stomach is in a great measure responsible for the dearth of medical literature on benign tumors and for the comparatively small number of case reports. The term polyp, originated by Galen for pedunculated tumors of the nose, refers not to a structural property but merely to the form which may be assumed by any growth. In this report we are interested in benign epithelial polypoid growths of the gastric mucous membrane; not in the single isolated growths, but in the multiple polyps involving diffusely the gastric mucosa. This condition is known as diffuse gastric polyposis, polyadenoma, adenomatosis gastrica, papillomatosis gastrica, etc. It is unavoidable that confusion should occur in the use of terms like gastric polyposis which signify no definite pathological entity. Brissaud was the first to classify his cases pathologically under the term polyadenoma; but it is noteworthy that later authors attempted with other terms to describe more fully this condition. The term adenopapillomatosis seems to describe more accurately the pathological picture, yet this term is far from being universally used or understood by the medical profession. In spite of the objections to it, the term gastric polyposis is firmly rooted in the minds of clinicians as a broad clinical, if not a pathological entity, and has been sanctioned by long and common usage both in the literature and in medical parlance. Some authors use it indiscriminately to designate all polypoid growths of the stomach, single or multiple; others, like Balfour, claim that it should be used to designate only the most widespread involvement of the mucosa and should not be confused with single polyps or papillomatous masses; while Meyer and others feel that there is no difference in kind between multiple polyps and solitary ones. For purposes of study we have here concerned ourselves with those cases having three or more polyps, and have collected all reports of such cases from the literature from 1820 to 1925, numbering 84 cases, including 5 proven personal cases. To this we have added 7 other cases which are probable but not yet proven.

Polyps of the stomach were known to Morgagni, who knew little of their true nature. Cruveilhier, in 1833, gave the first distinct conception of gastric polyposis. Andral distinguished between gastric polypi and cancerous tumors. Brissaud was the first to classify these polypi pathologically as polyadenoma. The first comprehensive study and classification was made by Menetrier, in 1888, who advanced chronic gastritis as the cause. Hauser, Watanabe, Wechselmann, Rosenbach, Disque, Meulengracht, Heinz, Anschuetz,

Fig. 1. Case of phytobezoar. Cellulose material retained in the stomach presenting a picture similar to that produced by polyposis, showing irregular coarse mottling throughout, with preservation of gastric outline.

Fig. 2. Case of phytobezoar, 3 months after anterior gastrotomy and removal of large amount of cellulose material. Stomach now of normal outline.

Konjetzy, and Chosrojeff are among those who advanced the study. The first antemortem diagnosis was made by operation in 1909 by Wegele. The first case diagnosed by X-ray was reported by Balfour in 1919. In 1922 Schindler reported the first and only case diagnosed by gastroscopy.

INCIDENCE

There is considerable disparity in the incidence statistics of gastric polyposis. This is in part due to the fact that they are often combined with statistics of polyposis of other portions of the gastro-intestinal tract. Among the more important ones are those of Ebstein,[1] who found 14 cases of gastric polyp in 600 autopsies, only 10 of which had 3 or more polyps; of Tigler, who found only 14 benign tumors of the stomach in 3,500 autopsies; and more recently of Balfour, who found only 1 case in over 69,000 abdominal sections at the Mayo Clinic, 8,000 of which were for gastric lesions. Doering reported 50 cases involving the whole gastro-intestinal tract, the stomach being involved in only 5 cases; Verse reported 55 cases, the stomach being involved in only 5, but never alone; of Port's 14 cases only 1 had stomach participation. In over 50,000 roentgenological examinations of the stomach, Carman encountered only 2 cases. These figures, however inadequate, show that the condition is extremely rare, yet the general impression prevails that it is much more prevalent than these statistics seem to indicate, and this seems to be verified by cases here reported, all occurring within the last 5 years. Males are more often affected than females. Of 16 cases collected by Mills, 12 were not over the age of 60, 5 were not over 40. Rosenbach and Disque in collecting all cases of stomach polyps single and multiple, note that most cases are between the ages of 60 and 70. Wechselmann in his report of polyposis of the whole gastro-intestinal tract, claims that the percentage increases to the age of 40 and then diminishes. Heinz notes that the young are affected by gastric polyposis more often than the old.

In a disease which is recognized so rarely and in which the patient may be symptomless for so long, one cannot expect the statistics of age incidence given by different writers to correspond closely. The average age in our own collected statistics (Table I) is 54 years, the youngest 20 years, the oldest 82 years.

[1] This reference has been verified from the original and has been frequently quoted but we feel that there must be some mistake in these figures, probably typographical.

Fig. 3. Case, 1, V. T. Polyposis gastrica. Arising from the middle third of the greater curvature of the stomach is a large lobulated irregular mass. At the site of attachment the greater curvature is broken up into small, thin lines, but is not totally absent as in a case of malignancy.

Fig. 4. Case 2, A. R. A constant large indented area near the middle of the greater curvature. The gastric wall is preserved for the most part, however.

The ages in 55 per cent of the cases are between 50 and 70 years. The proportion of male to female is as 3 to 2.

ETIOLOGY

The question of the etiology of such multiple growths of the stomach mucosa opens up the whole controversy over the origin of polypi in general. Among the various theories advanced in explanation of the origin of polyposis, two have received outstanding support.

The first claims them to be of congenital origin. Wechselmann thinks that the polyps emanate from epithelial fetal anlagen, separated during development, which are later stimulated to growth by chronic inflammatory irritation. Rippert accepts the congenital origin theory but claims that the connective tissue, not the epithelium, is the primary factor separating the epithelial cell complexes and irritating them to abnormal growth. That a certain hereditary influence is present among cases of gastro-intestinal polyposis is very probable inasmuch as the disease has been found in twins, in three, in four, and in six brothers and sisters, in a mother and son, etc. Wechselmann noted outspoken familial predisposition in 50 to 60 per cent of cases in which the whole gastro-intestinal tract was involved; Port in 5 out of 14 cases. In those cases in which the involvement covers large areas of both stomach and intestine, separated by a considerable extent of normal mucous membrane, the congenital factor is much more likely. Statistics which deal with the stomach alone are so few that they are not suitable for reliable deductions. In our complete series we have not found one case in which there was an unquestionable positive hereditary factor.

The second theory has a larger following, including Cornil, Menetrier, and Verse, who favor the theory of acquired origin, particularly by chronic inflammatory changes. The statement of Meulengracht that all cases sufficiently investigated show chronic inflammatory changes is not borne out, although a large percentage of the cases show such changes. Konjetzny claims to have found all stages from hypertrophic gastritis to adenoma and finally to carcinoma. Rosenbach and Disque claim that atrophic gastritis forms the soil for these growths, this theory being in part sup-

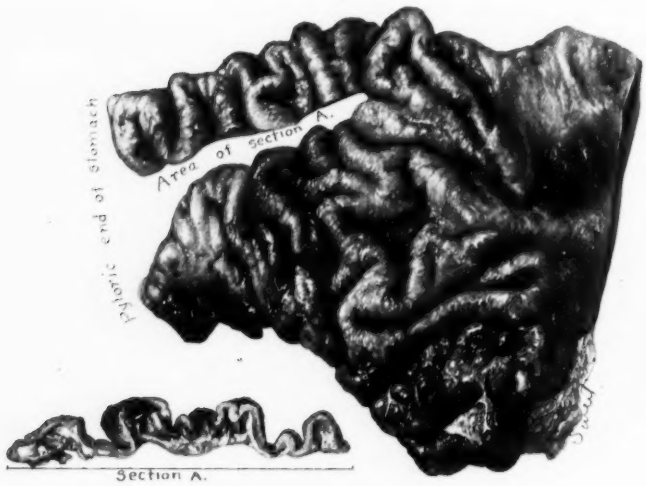

Fig. 5. Case 2, A. R. Specimen removed at operation showing hypertrophic condition of the mucosa with areas of hæmorrhage and necrosis.

ported by the fact that gastric anacidity is almost constantly present.

Tsukiaskas found marked epithelial hypertrophy in the stomachs of two monkeys, probably produced by irritation from ascaris. There are many other instances of the association of parasites with polyps both in men and animals, and it seems probable that in these cases the parasites may have had a definite etiological relation to the tumors, especially in view of the mechanical and chemical trauma which we know they produce. Ishibashi and Ohtani, by injecting coal tar into the submucosa of healthy rabbit stomachs, produced actual papillary adenoma; proliferation was evident by the second week and the tumor was well developed by the fiftieth day. In this connection it is interesting to recall Otto's case of gastric polyp surrounding a piece of wood, with no evidence of inflammation.

By far the most significant experimental work in this regard was done by Fibiger. By feeding a certain nematode previously not described, he was able to produce experimentally in the stomachs of healthy wild rats, widespread polypoid growths of the mucosa, the initial stages of which were epithelial hyperplasia and inflammation; and he was able to follow the lesions to malignant degeneration with unquestionable metastasis. These tumors often reached a colossal size and sometimes filled the entire cavity of the stomach. Fibiger thought that the anatomical changes in the rat were caused by toxins produced by the parasite. In the formed state the parasite inhabits the flat epithelium of the stomach and œsophagus of the rat; its necessary intermediate host is the cockroach. The roaches feed upon rat fæces containing nematode ova, and the larvæ travel to the skeletal muscles. Rats eat the roaches and thus are infected anew. The rats may be infected experimentally by feeding them cockroaches bearing these nematode larvæ but they cannot be infected by feeding them ova. Wassink, working with infected cockroaches obtained from Fibiger, reproduced the tumors in rats and also in mice, and from a large series was able to confirm in every detail the statements of Fibiger. In addition he found in native (Holland) rats a parasite very similar, if not identical to that described by Fibiger, which caused tumors not so large as those produced by the Fibiger parasite.

Against the theory of chronic irritation as a cause are the statistics of Lange who found

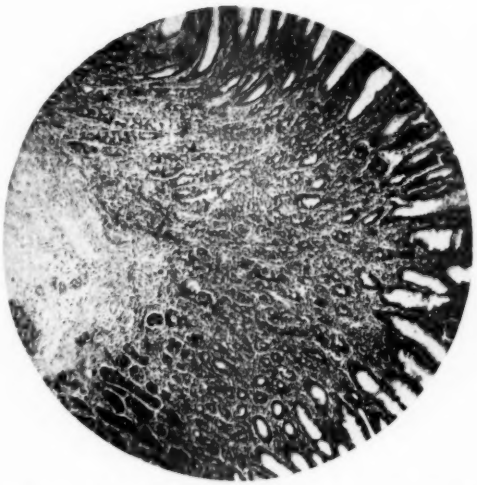

Fig. 6. Case 2, A. R. Low power photomicrograph showing general structure of the hypertrophic gastric mucosa. Note the endothelial spaces toward the periphery. Hæmatoxylin and eosin stain.

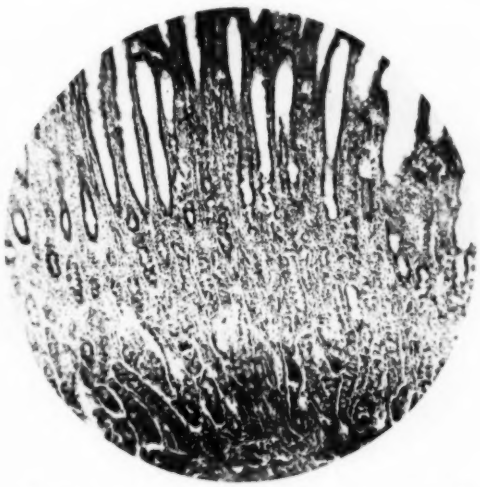

Fig. 7. Case 2, A. R. Low power photomicrograph, van Giesen stain, showing endothelial spaces which were filled with erythrocytes.

no polyps in 46 cases of chronic gastritis, but only the slightest hyperplastic phenomena; and of Perinin, who, in 50 cases of chronic gastritis in tuberculous subjects, found no evidence of tumor. Wechselmann notes that the appendix, which is the portion of the gastrointestinal tract most frequently involved by inflammation, has never been known to have a polypoid growth of the mucous membrane.

Hauser found small round intracellular bodies resembling the ones found by Pfeiffer and Weimer in variola, but there is no evidence that these bodies are protozoa, and most authors think they are cell degeneration products. Wechselmann admits that chronic irritation can produce epithelial overgrowths, but insists that these are not true polyps, not neoplastic but hyperplastic; while others who are exponents of the theory of chronic inflammation admit that there are some cases which are probably congenital. In our series, chronic inflammatory changes were found in 27 cases (32 per cent).

Hauser claims that the cause is a primary degeneration of the glandular epithelium, not congenital; that inflammatory changes are secondary and not found in the early growths; and that the polypoid form is the result of mechanical pull by the action of the stomach content on a growth already present.

The other theories of acquired origin such as alcoholism, atheroma of the gastric vessel, syphilis, amyloid degeneration, etc., are not

Fig. 8. Case 2, A. R. High power photomicrograph, van Giesen stain, centered on area noted by *x* in Figure 7, showing flat endothelium lining the dilated spaces. The spaces were filled with erythrocytes.

Fig. 9. Case 3, E. F. Two large rounded defects in greater curvature with irregular mottling but not complete loss of stomach outline.

generally supported and will not be discussed. It is interesting to note, however, that in our collected statistics there was a positive history of excessive alcohol ingestion in 8 cases (9 per cent). In only 2 cases was there a positive Wassermann and in 1 case there was a history of syphilis but a negative Wassermann.

It is very probable that there are two types of epithelial overgrowth, an hyperplasia secondary to inflammation, and an hypertrophy congenital in origin. It is our experience from sections taken from some of our own cases, which conformed more to the congenital type, that the epithelium assumes the dominant rôle, the connective tissue being relatively passive, and that evidence of chronic inflammatory changes is distinctly secondary.

PATHOLOGY

In contrast to the dispute which rages over etiology, there is fairly close agreement among various writers as to the pathological findings. The early classification of Menetrier is still regarded by many as satisfactory. He divides polyposis into two types: one type, polyadenoma *polypeaux*, in which many discrete, usually pedunculated, lobulated tumors bearing frequent cysts affect diffusely the gastric mucosa; and another, polyadenoma *en nappe*, in which the hypertrophy forms a raised, well demarcated plaque, not lobulated, cystic, nor pedunculated, composed of closely placed folds of hypertrophic mucous membrane. The first type is thought to be the result of hypertrophic changes involving the ducts and necks of the glands, with well marked participation of connective tissue elements which form the stalk and ground work of the tumor pattern. The second type, more rare, is thought to be a more purely epithelial growth involving the fundus of the glands. Only 5 cases of this type are on record. Menetrier describes a case in which both varieties were present in the same specimen. Menetrier, however, claims that all polyps are inflammatory in origin and makes no distinction between his cases and those which are reported by others as congenital in origin.

As has been noted, we feel strongly that a distinction must be made between two types of multiple polypoid conditions of the gastric mucosa, a congenital hypertrophy, and an hyperplasia acquired through chronic irritation.

It is recognized that the boundary which separates neoplasm from hyperplasia is very uncertain. The most widely accepted criteria of hyperplasia may be satisfied by undoubted adenomata, especially in the early stages when both morphological and functional identity often exists. That actual extensive polypoid growths can be produced by chronic irritation can hardly be doubted in the face of the significant experimental work of Fibiger and Wassink, already mentioned. In writing of the differences between true neoplasms and hyperplasias in the gastro-intestinal tract, Wechselmann states: "In contrast to the sharp boundaries of the adenomatous tumors, the defective margins in these inflammatory hyperplasias merge into the normal tissue. The border of the hyperplastic mucous membrane has a slow rise to a hilly slope and is more flat and spread out on account of the wide extent of the inflammatory irritation. In them the impression of an independent, suddenly arising, and isolated tumor is lack-

Fig. 10. Case 3, E. F. *a*, Number, size, and position of tumors. *b*, A large mass, clamped at its base is being removed with cautery irons. The strip of healthy mucous membrane separating the polyps can be seen. *c*, Cross section of a characteristic polyp, showing the fibrous core and the superimposed hypertrophic epithelium.

ing. Their structure is coarse in comparison to the dainty adenomata, their height is insignificant, and there is never a differentiation into head and stalk. Their consistency is firm, they rest immovable on the mucous membrane. The folding and swelling of the mucous membrane seen macroscopically is found on microscopic examination to consist of a thickening of the mucosa and a diffuse increase and enlargement of the glands, the structure of which shows no departure from the normal. It is especially noteworthy that in contrast to the other polyps the submucosa takes no part in the growth as a connective tissue core."

The discrete polyps are usually soft, smooth, and lobulated, and contain small cysts. On pressure they exude a considerable quantity of mucus; and a thick layer of similar mucus often overlays the surface of the gastric mucosa. Some are pedunculated, some broad based, some spherical, some hemispherical, and one finds button-like prominences which represent tumors in the early stages. They are usually lentil to nut size, although wide variations in size are met with from minute

Fig. 11. Case 3, E. F. Low power photomicrograph. The epithelium has broken through the muscularis mucosæ. Note the complex character of the gland spaces, with numerous side processes.

warty excrescences, which become visible only when the stomach is submerged in water, to large growths, the size of a fetal head. The color varies from gray to reddish brown depending on the vascularity of the tumor. All are covered with a thick layer of mucosa which may display punctate hæmorrhages or areas of necrosis and ulceration. They are freely movable on the submucosa. The intervening mucosa in this type is usually not altered but sometimes one sees an increase in the size of folds. Section shows the tumor to consist of a marked thickening of the mucosa with a core of connective tissue from the submucosa.

On microscopic examination of a discrete polyp, one finds a fairly orderly arrangement of epithelial cells lining gland spaces in an adenomatous pattern. These are supported by a fairly well marked connective tissue stroma. The epithelium is cylindrical or cuboid, having basal nuclei which contain well defined nucleoli, and deep staining cytoplasm showing a variable tendency to produce mucus. The distinction between chief and parietal cell is lost. The cells are single layered and show some evidence of metaplasia. Mitoses are infrequent. The glands are variable in size, ranging from epithelial plugs to large dilated cystic spaces. The lumina are often filled with a homogeneous substance resembling mucus. The stroma is usually well marked and contains an occasional lymphocyte and plasma cell. In the benign condition the hypertrophy is definitely limited by the muscularis mucosæ. The submucosa appears normal.

The picture is often modified by secondary changes. The most frequent changes are inflammatory, the most important are malignant. Inflammatory changes are due to trauma, mechanical or chemical, or to actual bacterial invasion. In such cases one sees the epithelium damaged; the interglandular tissue, and sometimes also the lumina of the glands filled with exudate consisting of polynuclears and lymphocytes; and the blood vessels hyperæmic. Occasional blood extravasations into the interglandular tissues or even into the gland spaces are seen. Cases are reported of the occurrence of true abscesses in gastric polyps. When tumors become detached from their pedicles they are exposed to the digestive action of the gastric enzymes for variable periods, and corresponding lytic changes are seen in the superficial layers of the tumors. Widespread inflammation and digestion were noted in the specimen vomited in our Case 10, in which there was undoubtedly a large element of active acute inflammation as evidenced by the large number of polymorphonuclear leucocytes both in the specimen and in the gastric content.

Malignant degeneration in this condition is evidenced by changes similar to those occurring in malignant epithelial degeneration elsewhere. The epithelium becomes many layered, more undifferentiated, exhibits polymorphism, grows in a disorderly fashion, and mitosis becomes frequent. Finally the epithelium bursts its normal barriers and breaks through the muscularis mucosæ, entering the submucosa. It is only at this stage that we can be sure that the growth has assumed a malignant character. In our Case 3, it was only after diligent search that Dr. Rusk could demonstrate actual invasion (Case 3, Fig. 11). Miller reports a case of solitary polyp of the stomach in which unquestionable metastases

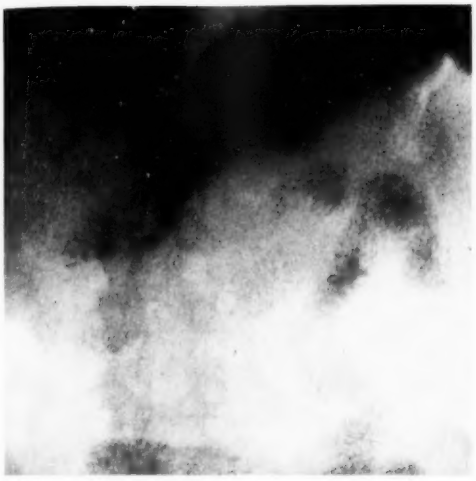

Fig. 12. Case 3, E. F. Roentgenogram taken 16 months after operation showing a recurrent polypoid mass in the cardiac end of the stomach; marked contraction of the pyloric antrum and pylorus, which is connected with a mass palpable subcutaneously. Probably malignant. Patient's general condition, however, is very good.

Fig. 13. Case 4, R. A. W. Roentgenogram showing multiple punched out areas throughout gastric shadow with preservation of gastric outline. Typical "undercutting" is well shown on the area in the lesser curvature marked with arrow. From the X-ray examination a diagnosis of multiple gastric polyposis was made.

were found, but in which it was impossible to demonstrate deep infiltration in the primary growth.

In the cases which conform more to the acquired type, the description of Wechselmann, quoted above, leaves nothing to be added. In these cases the intervening mucosa and also the submucosa show all the signs of chronic gastritis.

Rosenbach and Disque claim that atrophic gastritis is the primary factor in the formation of polyps, and have described cases in which the phenomena of atrophy and hypertrophy are found side by side. In such cases the hypertrophy is thought to follow the atrophy, and these authors claim to have found all stages from atrophic gastritis to small adenomata.

In one of our cases the thickening of the mucosa in the form of a plaque, resembling polyadenoma *en nappe* was found on closer study to be the result of a telangiectatic formation in the mucous membrane composed of true endothelial spaces filled with blood. Another similar case was reported by Monfalcon (1820), who described an extraordinary polyp, the structure of which resembled that of the corpus cavernosum. It is very possible that in the past this type of tumor has been confused with the true epithelial formations, especially the *en nappe* variety.

The lower third of the stomach is most frequently involved, but the change stops abruptly at the duodenum. Brissaud claims that the polyps are most numerous over the area in which the pepsin forming glands abound. Basch notes that single polyps are most numerous near the pylorus, multiple ones in the middle portion of the stomach. Our own collected statistics show that in 86 per cent of cases in which the situation of the tumor was given, the lower third of the stomach was involved; and in 35 per cent of the cases, the lower third was involved alone. The upper third was involved in only 50 per cent, alone in only 6 per cent. The middle third of the stomach was involved in 56 per cent, alone in 3 per cent. The greater curvature was involved in 54 per cent. The lesser curvature was the least frequent site, having been involved in only 40 per cent. The entire stomach was involved in 20 cases (28 per

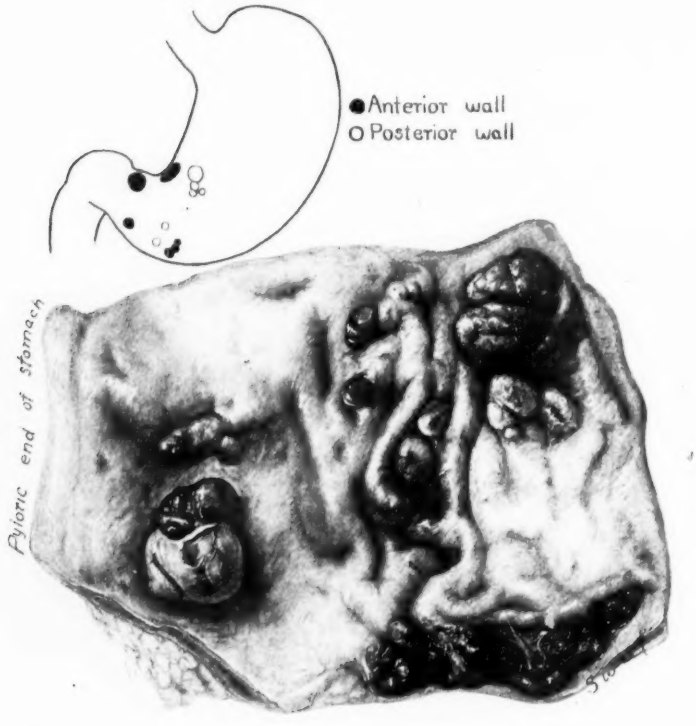

Fig. 14. Case 4, R. A. W. Surgical specimen showing multiple polypi of the mucosa. Diagram indicates position, number, and relative size of the tumors. One tumor is not shown since it lay above the line of section. This tumor was removed separately and its base thoroughly cauterized.

cent). These statistics show that the lower third and the greater curvature are the sites of predilection for the disease. Coincident involvement of other portions of the gastrointestinal tract was noted in only 6 cases (7 per cent).

The tumors vary widely in number; the report of one case records over 400 discrete growths. They are scattered diffusely or arranged in parallel rows, often in clusters. Sometimes the mucosal surface presents a picture which strongly simulates cerebral convolutions, as depicted in Case 2, Figure 5. It is not unusual to find a single large polyp, and in the immediate vicinity of its base, several smaller ones; or to find the neighboring mucosa thrown into large numbers of small tufts. Some authors claim that these should be considered as one tumor, but since no good reason for this has been advanced we have considered them as separate ones.

A considerable degree of interest has centered about the hyaline bodies which abound in the tumor tissues. These bodies, first mentioned by Rindfleisch in 1878, were found in large numbers in the mucous membrane of the stomach by Krukenberg in 1890, who called them colloid bodies. Russell studied them carefully and named them fuchsin bodies. Many others have "discovered" them and attached their own name to them. They have been found in a wide variety of pathological as well as normal tissues, as elements of the stroma. Various authors have called them

parasites, lymph coagulation products, cell degeneration products, erythrocytes, etc. Dr. G. Y. Rusk states that these bodies are merely degenerated plasma cells.

It is interesting to note that diffuse polyposis has been found in animals, notably the dog and the horse. A case of polyposis in the horse is reported (Petit et al.) in which the macroscopic and microscopic findings agree with the descriptions given by Menetrier of polyadenoma *en nappe*.

SYMPTOMS AND SIGNS

Gastric polyposis frequently runs a course without symptoms and may be disclosed only at autopsy. When present, the symptoms are the same type as one may meet in any gastric disorder: epigastric discomfort, distention, vomiting, etc. Abdominal pain or distress is by far the most frequent symptom present in 24 cases (28 per cent). Often the patient complains of symptoms which are the result of a long continued severe anæmia. The nearly constantly present anacidity often reveals itself by diarrhœa, the latter being present in 15 cases (18 per cent). Vomiting, anorexia, constipation and weakness were each present in about 17 per cent. Hæmatemesis is reported in 7 cases out of the 84 (8 per cent), but death from severe hæmorrhage is not known in the diffuse variety of polyposis. In 1 case (Heinz) the lavage water was tinged bright red on several occasions, once after an interval of 2 years. Occult bleeding is much more frequent, having been noted in the stools in 11 cases (13 per cent), this usually being the result of mechanical injury to the growths. To a certain extent the symptoms depend on the location, size, and form of the tumors. Pedunculated masses and masses about the pylorus are much more apt to produce symptoms than broad based ones and tumors of the greater curvature. A remarkable case of gastric polyposis in an epileptic is reported (Stevens), in which the aura was referred consistently to the stomach.

Reports are at hand of 4 cases of pyloric obstruction caused by gastric polyps. In Cruveilhier's case there was only gastric retention; in Cornil's there was complete obstruction; in Myer's there was invagination

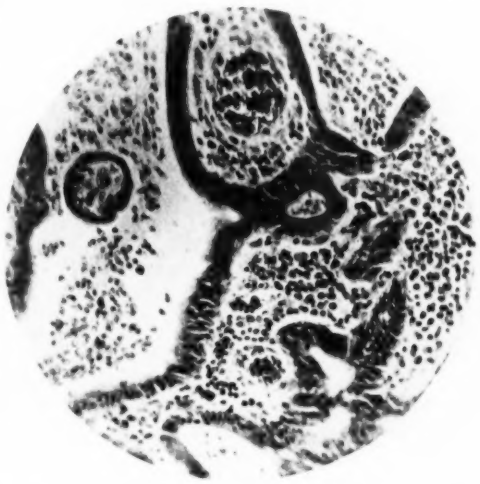

Fig. 15. Case 4, R. A. W. High power photomicrograph. Typical view of the epithelial growth, showing irregular branching gland spaces lined with undifferentiated epithelium containing leucocytes and red blood cells. The stroma contains many lymphocytes and plasma cells. Hæmatoxylin and eosin stain.

of the pylorus into the duodenum. To this series of cases of pyloric obstruction we are able to add a personal case (Case 5) which occurred in the practice of Dr. T. O. Burger of San Diego who has kindly permitted us to include it in our series. There the obstruction was intermittent, lasting 12 to 36 hours, and when present, was associated with severe pain and constant vomiting.

Some of the cases have displayed a remarkably long duration of symptoms without progression. In Wegele's case the patient suffered for 29 years before the condition was correctly diagnosed. In Menetrier's case symptoms were present for 25 years. In one of our own cases (Case 1) the symptoms dated back 25 years; in another probable case, 20 years. In several cases the duration of symptoms was 10 to 15 years. One must conclude, then, that the disease often remains benign for the greater part of its course. In our Case 1, a marked increase in severity of symptoms seemed to correspond to a sudden increase in growth activity displayed by tumors which lay dormant for over 20 years. The repetition of symptoms is not seldom interrupted by

Fig. 16. Case 5, A. R. This picture was taken when the polyp had herniated into the pylorus showing the sharply cut off area at the antrum and pylorus.

Fig. 17. Case 6, W. F. Shows defect along greater curvature of stomach. Note preservation of old gastric outline.

Fig. 18. Case 7, A. S. Large reticular defect in middle of greater curvature of stomach due to either hypertrophied rugæ or polyposis.

Fig. 19. Case 8, W. B. Irregularity along the greater curvature extending from the cardia for two-thirds of its length. This cannot be smoothed out by pressure.

Fig. 20. Case 9, H. S. Examination after 15 hours' fast, preceded by gastric lavage, shows the stomach not quite empty. This very satisfactory filling demonstrates some large, irregularly rounded filling defects over the upper portion of the greater curvature.

Fig. 21. Case 10, J. C. Defects shown in gastric outline and in middle portion of stomach in many places. Multiplicity of lesions and maintenance of gastric outline speaks for polyposis. This was substantiated by finding tumor tissue in vomitus.

Fig. 22. Case 11, N. E. The roentgenological findings of the stomach were extremely significant. There was a marked irregularity of the greater curvature. At a second examination, the irregularity of the greater curvature was proved to be characteristic of diffuse polyposis.

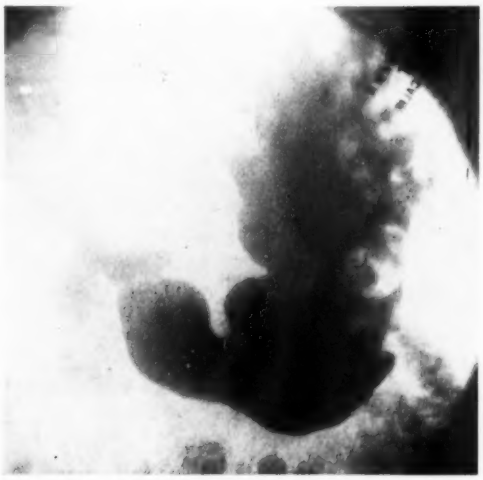

Fig. 23. Case 12, E. K. Female age 30, had symptoms lasting 10 to 12 years. History of manifest and occult blood in the stools. Stomach content showed great quantity of mucus; no free hydrochloric acid. X-ray typical of polyposis, but operation disclosed marked hypertrophic gastritis.

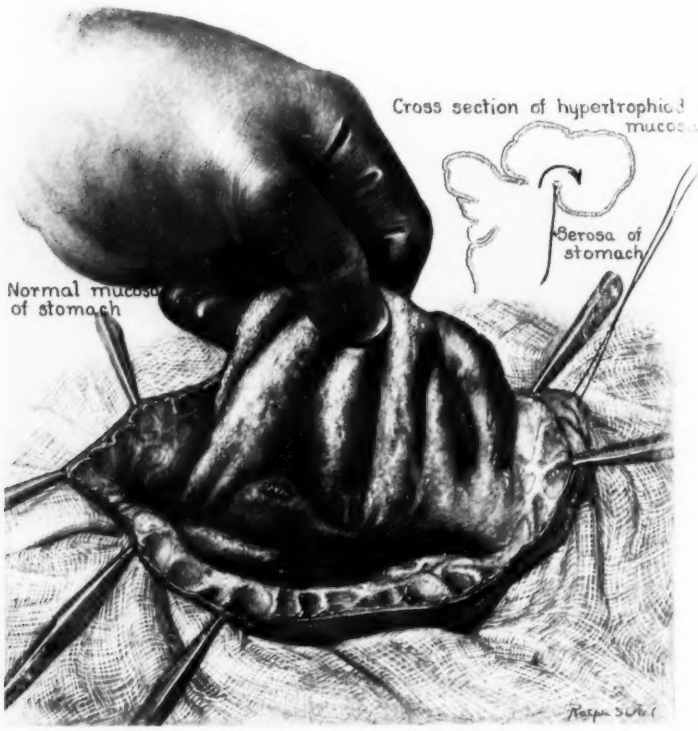

Fig. 24. Case 12, E. K. This shows the enormously hypertrophied folds of gastric mucosa as they are actually being withdrawn from the stomach through the gastrotomy incision. The area of hæmorrhage noted in the text is here shown.

remissions of variable duration. Our probable Case 10 enjoyed a spontaneous remission of over 9 years' duration.

In this series of 84 cases, objective physical signs were usually lacking, having been found in only 9 cases (11 per cent). A palpable tumor was noted in 1 case only. Eight cases showed only slight tenderness or a sense of resistance in the epigastrium.

How much of the symptomatology is the result of the polyps themselves and how much of the chronic inflammatory changes which sometimes accompany them is problematical. It has been suggested that the polyps are silent and that the symptoms result from the chronic inflammation alone, except when obstruction or some other mechanical factors prevail.

DIAGNOSIS

It is remarkable that from 1830 to 1909 all the cases of gastric polyposis collected from the literature were diagnosed at autopsy. The first antemortem diagnosis was made by Wegele in 1909, operating for a suspected carcinoma of the stomach which had been incorrectly diagnosed as such from a piece of tissue expressed through the stomach tube. As in the past, so in the present, many cases are undoubtedly overlooked because they may remain symptomless over a long period of time and because the symptoms, when present, are not characteristic. The roentgenogram properly interpreted, should overcome this difficulty, although in our own series of cases, we will show that confusion and doubt may arise from a lack of knowledge of the various

Fig. 25. Case 12, E. K. Low power. Showing *1*, cleft in mucous membrane; *2*, overlying œdematous area; *3*, small cystic dilatation of gland; *4*, cellular infiltration.

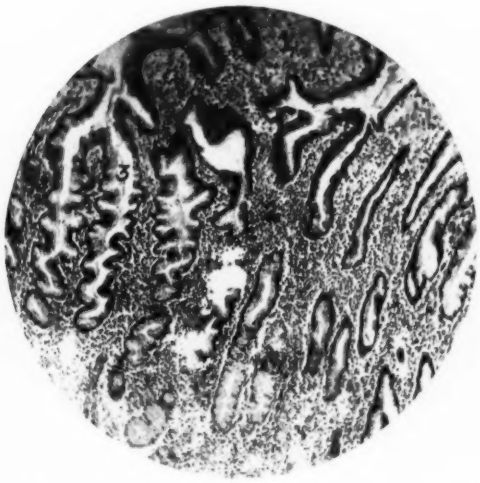

Fig. 26. Case 12, E. K. Photomicrograph of surface of mucous membrane, showing *1*, œdematous region; *2*, cellular infiltration; *3*, tortuous glands.

changes which may occur in the contour of the stomach resulting from these growths and from the inability to discriminate between chronic inflammatory hypertrophy and neoplasm by the roentgenogram.

Dr. Howard Ruggles, who has seen a large percentage of our cases, offers a personal communication of the roentgenological findings in polyposis as follows: "The characteristic roentgen-ray finding in polyposis consists of irregular defects in the margin of the gastric shadow at the site of the tumors which are usually upon the greater curvature. The masses projecting into the lumen produce an indentation in the barium shadow with ragged edges and there is commonly a tendency for a streak of barium to continue along the curvature of the stomach extending through the lesions for a variable distance depending upon the angle at which they are viewed. When a tumor lies directly on the profile of the shadow and has a relatively broad base, there will be little or no 'undercutting' visible. When the base of the tumor lies at a slight distance from the profile, this tendency of a thin line of barium to follow the gastric outline becomes more pronounced and, finally, when the tumor arises from the anterior or posterior walls, the defect in the margin disappears entirely and the picture is that of a more or less rounded mass lying wholly within the gastric shadow.

"The differentiation from carcinoma is made upon the fact that the defect in malignancy is usually annular, involving both curvatures, the gastric wall at the side is obliterated, and the defect increases in size fairly rapidly, while the course of the benign lesions is much slower.

"Foreign bodies such as food, hair balls, masses of vegetable fibers, and other non-opaque material may be a source of confusion on single examination but repeated observations and changes in position of the patient should differentiate them."

The method of differentiation of benign from malignant gastric neoplasms by the X-ray is well set forth by Moore in this country and by Z. Kalisch, D. Kalisch, and Gassmann in Germany, who lay special emphasis on defects produced by polyps.

Just as in the pathological picture, so in the roentgenograms, there are borderline cases in which one cannot differentiate between hypertrophic rugæ resulting from chronic gastritis and polyposis. This is well exemplified

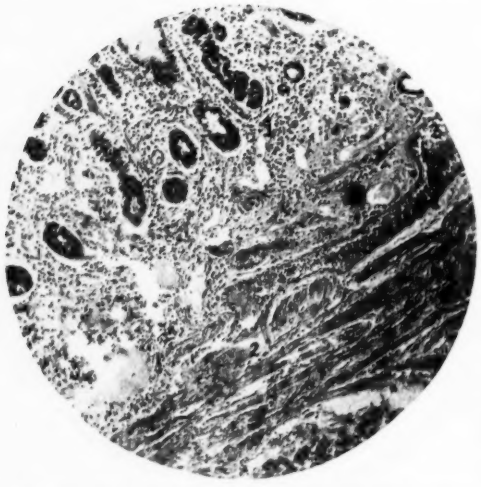

Fig. 27. Case 12, E. K. Photomicrograph of inner layer of mucous membrane, showing *1*, general œdema and dilatation of capillaries; *2*, extension of infiltration among fibers of œdematous muscularis mucosæ; *3*, vessel containing extensive number of leucocytes.

by our Case 12 in which the history, laboratory findings, and roentgenogram were so characteristic that we were tempted to report this case before operation as proven. To our surprise, however, we found at operation a marked hypertrophic condition of the mucosa without any discrete growths.

Dr. Chamberlain, in a personal communication, cited a case diagnosed polyposis by X-ray which was found at operation and microscopic examination to be one of multiple nodules of lymphosarcoma. He feels that in some cases one cannot make the differentiation between lymphosarcoma and polyposis by the roentgenogram alone. We have not encountered any cases in which the X-ray picture was confused with lymphosarcoma.

Carman, too, warns that the roentgenograms of polyposis may be confused with those produced by vegetable matter retained in the stomach; but it is our good fortune to be able to present a case of just this nature, confirmed by operation, in which Dr. Lloyd Bryan was able to differentiate easily these two conditions from the roentgenogram alone (Fig. 1) by the fact that the gastric outline was easily traceable and found not to follow the defects, the latter being ragged and not well defined, displaying a moth-eaten appearance.

P. B.,[1] a Hindu laborer, age 55 years, entered the San Francisco Hospital[2] in August, 1925. His family history was unimportant. Until the age of 40 years he had lived in India. At the age of 48 he had chancre and gonorrhœa with secondary rash, treated by a doctor, with mercury rubs. He had no other diseases, and was never jaundiced. Two years ago he suffered from pain between the shoulders radiating down both legs and at about the same time he passed two renal calculi. In addition, his physician made a diagnosis of diabetes and since then he has suffered from polydipsia, polyphagia, and polyuria. For about 3 years, he has suffered from a feeling of fulness and tightness in his abdomen, at first only after meals, but later nearly constant, relieved temporarily by belching. This was associated with a dull pain in the right epigastrium which did not radiate. He has also had occasional attacks of nausea and vomiting coming on soon after eating. Vomitus never contained blood. During his illness he has had attacks of diarrhœa, sometimes 6 to 8 stools daily, never bloody nor tarry. Two days before entry he passed two calculi through the urethra. His weight never was over 100 pounds. His weight on entry was 82 pounds.

On physical examination the positive findings were dental caries and pyorrhœa, visible active intestinal peristalsis, clubbing of fingers and toes and absence of patellar and Achilles reflexes. No other abnormality was noted in the abdomen. The chest was normal.

Gastric analysis was done on August 18, 1925. The fasting content, measuring 15 cubic centimeters, was macroscopically and microscopically normal. Chemical analysis showed total acid of 80–85 and free acid 15–30. Blood sugar (fasting) 301 milligrams glucose on August 24, 1925, and 176 milligrams on September 11, 1925. Roentgenological examination of chest and abdomen made August 20 by Dr. Lloyd Bryan, showed slight dilatation of the arch and ascending aorta; enlargement of bronchial root glands; increase in peribronchial thickening; no delay in œsophagus. The stomach, large, low, atonic, showed diffuse irregular and coarse mottling throughout; the outline was not broken, rugæ were demonstrated, peristaltic waves normal. The duodenal cap was medium in size and smooth. Re-examination of the stomach after lavage showed irregular coarse mottling throughout. There were no actual gastric defects. Rather marked retention appeared after 6 hours. Roentgenological examination showed no retained foreign material in the stomach. The urine showed a heavy trace of sugar and the occasional presence of acetone; it was otherwise negative. Erythrocytes numbered 4,000,000; leucocytes 6,300; 72 per cent polynuclear neutrophiles. Blood Wasser-

[1] This case was reported by Dr. Lloyd Bryan at the Dallas Convention of the American Medical Association, 1926.

[2] University of California service.

mann was negative; examination of stool negative. Diabetic diet regime was instituted.

On September 17, 1925, a futile attempt was made to pass an œsophagoscope under local anæsthesia. The following day gastrotomy was performed by one of us and large quantities of vegetable matter and retained food material which could not pass the pylorus were evacuated. The convalescence was uneventful except for slight infection in the operative wound. Blood sugar, September 21, 1925, was 183 milligrams per 100 cubic centimeters. October 4, 1925, he was discharged from the Surgical Service in good condition, the urine being sugar free.

Three months after operation the patient complained that the feeling of tightness in the abdomen and the diarrhœa had increased in severity. Roentgenograms taken at this time showed a stomach normal in contour and function, without evidence of retained vegetable matter or any other abnormality (see Fig. 2).

Such examples of phytobezoar are exceedingly rare. Hart, in 1923, collected five cases of bezoar from the literature, some of these, however, being pure hair ball (trichobezoar) or a mixture of hair and vegetable matter (trichophytobezoar). To these Hart added 8 personal cases, all of them phytobezoars, which are very similar to the case reported here, and gave interesting histories and roentgenological views. It is a remarkable fact that in 6 of Hart's 8 cases, there was a definite history of persimmon ingestion. This was not so in our case. It is interesting to note that our case of phytobezoar was a diabetic. Dr. H. C. Moffitt, in a personal communication, recalled two cases of intestinal obstruction in diabetics due to retained vegetable matter. It may be that there is a casual relationship between diabetes and phytobezoar. Hart, however, makes no mention of the occurrence of diabetes in his case reports.

It is noteworthy that in every case in which the X-ray was utilized for diagnosis there was definite abnormality in the roentgenograms. However, a typical case may be overlooked not only by the roentgenologist inexperienced in this condition but actually by the exploring surgeon.

Laboratory investigation often furnishes important data. Next to the roentgenogram, the examination of the gastric content assumes first importance. It is remarkable that of 20 cases in which gastric analysis was performed, free hydrochloric acid was absent in 18 (90 per cent). This finding is even more constant than it is in carcinoma. In only one case was there mention of the presence of ferments. Blood, occult or manifest, was found in the fasting content in 9 cases (45 per cent); tumor particles were found in 5 (20 per cent). A large amount of mucus was present either in the gastric content removed by tube or overlaying the gastric mucosa, in 11 cases. Myer states that achylia and myxorrhœa should always arouse suspicion, especially when repeated fresh blood is found in gastric content removed with care; and that severe acute gastric hæmorrhage in a patient with gastric achylia, abnormal mucous production, and normal or increased gastric motility make the presence of the disease more than probable.

Tumor tissue received from the stomach by tube or in vomitus may suggest the presence of gastric polyposis. Wegele, Chosrojeff, Myer, and Heinz reported the finding of tumor tissue which lead to a diagnosis. In Wegele's case, from a microscopic examination of the tissue, a diagnosis of carcinoma was made and we had a similar experience in one of our cases (Case 10). The differential diagnosis between polyposis and carcinoma from pieces of tumor tissue will always be uncertain, since such specimens rarely contain the submucosa in which the actual invasion can be demonstrated. Chosrojeff recovered tumor tissue from the stomach of a patient on two different occasions. Myer recovered a gastric polyp from the stools of a patient, in whom he first diagnosed invagination of the polyp through the pylorus and separation from the pedicle. In obscure gastro-intestinal cases and in obscure anæmias, gastric analysis should not be neglected and rigid search should be made for tumor particles, the microscopic examination of which may suggest the diagnosis.

In obscure gastric cases which come to the surgeon for treatment, the operator should not be content with inspection of the serous surface of the stomach alone and palpation of the closed viscus, but gastrotomy should be performed whenever possible and the mucosa directly inspected. In this way, many supposedly normal stomachs will be found to be the seat of well advanced pathological change.

In two of the probable cases reported by us, a pre-operative diagnosis of ulcer led to the performance of a gastro-enterostomy in one and a pylorectomy in another, overlooking the presence of gastric polyposis.

Schindler, in 1922, reported the first and only case diagnosed by gastroscopy. Were it used more frequently this method would probably become a potent means of diagnosis not only of polyposis but of other diseases of the stomach.

With the above facts available, the diagnosis of gastric polyposis should rarely be overlooked, and the number of case reports will undoubtedly mount quickly in the future.

PROGNOSIS

Statistics which bear on prognosis, important as they are, are very inadequate, principally because most of the cases have been diagnosed postmortem. Death has rarely been the direct result of the presence of the disease. That these growths are essentially benign is conceded by all; the importance of gastric polyposis lies more in its tendency to undergo malignant change. Wechselmann claims that 50 to 60 per cent of cases of polyposis of the entire gastro-intestinal tract become malignant, and that it is unusual for a case to remain benign until death. Doering claims that 46 per cent of cases in which the entire gastro-intestinal tract is affected are associated with carcinoma and that most of these occur between the ages of 15 and 35 years; after 4 years, only one patient, a girl of 15 years, was alive. Statistics which involve the stomach alone are few and inadequate. Meulengracht states that 50 to 60 per cent of intestinal polyps undergo malignant degeneration, but that in the stomach, malignant change seldom occurs and is not the rule. Less than 17 per cent of his cases showed malignant degeneration. Mills reports that only 4 cases in 20 were malignant. In our collected statistics 12 per cent showed malignant degeneration.

One must not lose sight of the fact that in the examination for malignancy, only a small portion of the entire specimen is utilized and that outspoken malignant changes may lurk in an unexplored field. Again, it is often extremely difficult, in borderline cases, to determine definitely whether or not a tumor has actually become malignant. Most pathologists agree that invasion of the submucosa by epithelial elements is evidence of carcinomatous change. There are those, however, who claim that the type of cell and its arrangement are sufficient; that the change from orderly, functional, single layered epithelial cells to undifferentiated, metaplastic, polymorphic, many layered cells, without evidence of function proclaim the malignant change. Miller reports a case of unquestionable metastasis in a case of malignant polyp of the stomach in which he was unable to demonstrate deep invasion in the primary growth. Rosenbach and Disque claim that malignant degeneration occurs more often in broad based polyps. In our personal series, the diagnosis of malignancy was made to rest on actual invasion of the submucosa.

TREATMENT

Deductions of treatment from present statistics are premature in view of the small number of cases diagnosed before death. Douglas allowed his patient to swallow a capsule of radium tied to a string, which was left in the stomach for 6 hours with frequent change of position; the patient died in 3 months.

X-ray therapy was employed on one of our personal cases (Case 10) with considerable improvement. In the case reported by Struthers, therapeutic X-ray treatment was also used, with relief from all symptoms for 3 months, after which time the symptoms returned, increased in severity, although the roentgenogram showed no signs of progression of the disease. One cannot be sure, however, whether an etiological relationship existed between the procedure and the improvement, or whether the latter was a coincident spontaneous remission such as is not unusual during the progress of the disease. No other reports of non-surgical treatment have been found.

The liability of these tumors to develop into malignancies argues strongly for radical surgical procedures. As much of the tumor bearing area should be excised as possible. The remaining tumors should be individually

excised, their bases cauterized thoroughly, and the defect in the mucosa closed by suture. The nature and extent of the procedure, of course, will depend on the condition of the patient. If transfusion is necessary it should be done several days before operation, to avoid the added shock of possible transfusion reaction (see Case 4). Local anæsthesia with or without splanchnic block is the most satisfactory anæsthetic.

PROVEN CASES

CASE 1. V. T., an Armenian laborer, age 62. entered the Surgical Service of the University of California Hospital in January, 1921, complaining of weakness, shortness of breath, loss of appetite, and nausea after meals. His family history was unimportant. He had gonorrhœa three times, once complicated with suppuration of the inguinal glands; chancre at the age of 32, treated only with cautery. He gave no history of secondary syphilis, but 20 years later he was cured of skin lesions by intravenous administration of salvarsan, following the discovery of a positive Wassermann reaction in the blood. Four years ago he was operated upon for the relief of prostatism. His gastro-intestinal history dates back 25 years (aged 37), when he was confined to the St. Helena Sanatorium for 7 weeks because of "stomach trouble," weakness, nausea, and the loss of 40 pounds in weight in 2 months. At that time gastric analysis showed absence of free acid. Since then he has been subject to attacks of pain about the umbilicus, and nausea, especially about 1 to 2 hours after consuming meat or large amounts of food. Five months age he noticed that the nausea and pain became more severe and constant, and occurred soon after ingestion of food (15 to 30 minutes); he desired to vomit but never did. Very light meals were not followed by nausea. At the same time he began to experience marked weakness and shortness of breath on exertion and noted that his ankles would swell at night. He has been constipated for years; never noticed bloody or tarry stools. Physical examination showed marked dental caries; generalized arteriosclerosis; abdomen normal except for a questionable, tender mass just below the xyphoid which does not move with respiration; slight œdema of the scrotum. Otherwise examination was negative. Laboratory findings: Blood, examination showed hæmoglobin, 60 per cent; red blood cells, 3,104,000. The urine was normal. Gastric analysis showed occult blood in fasting content; no free acid; numerous leucocytes; few gastric epithelial cells. The stomach was washed with saline solution. The wash water contained many fragments; occult blood, positive; centrifuged specimen showed many erythrocytes and polymorphonuclear cells. The Wassermann was negative. Roentgenological examination showed a wide aortic arch, the stomach rather small and high and no masses present. The lower end of the stomach was funnel shaped and slightly irregular, cap normal. From roentgenological examination a diagnosis was made of early carcinoma of the antrum. Examination of stools showed occult blood present (two examinations).

A pre-operative diagnosis of carcinoma of antrum, with metastasis to the head of the pancreas was made. Operation was done by Dr. S. Pope January 8, 1921. An old ulcer at the pylorus was found. The remainder of the stomach was normal to palpation. The pyloric musculature was markedly thickened. Treatment included a Mayo-Pólya resection of the pylorus. Pathological report: stomach ulcer; no evidence of malignancy (Dr. Bartlett).

The patient had an uneventful recovery and was discharged cured, February 3, 1921. Diagnosis: Ulcer of stomach.

On October 4, 1921, the patient entered the San Francisco Hospital. Following his discharge from the University Hospital, he enjoyed transient relief for a few months, during which he gained 15 pounds. One month before entry his gastric symptoms returned, increased in severity. He suffered from a raw feeling in his epigastrium; sometimes even a sharp pain; nausea was marked, but he did not vomit. He had tarry stools at irregular intervals. Although his appetite was good, he feared to eat. In January his weight was 160 pounds; now it is 152 pounds. Physical examination revealed an anæmic man, suggestive of the pernicious type of anæmia. Except for vague resistance in the epigastrium and tenderness here on deep palpation, there were no important signs. Examination of the blood showed hæmoglobin 55 per cent (Dare), red blood cells 4,160,000.

Roentgen examination, October 10, 1921 (Fig. 3) showed no evidence of pathology in the chest; no delay in the œsophagus; no cardiospasm. The stomach was small and high and the antrum had been resected and united directly to the duodenum. Through this opening, the stomach was emptying rapidly. No peristaltic waves were visible. Arising from the middle third of the greater curvature was a lobulated irregular mass. At the site of the attachment, the greater curvature was broken up into small thin lines but was not totally absent as is true in a case of malignancy. From roentgenological examination a benign polypoid growth was diagnosed. Pre-operative diagnosis was gastric polyposis. Operation was done by one of us, San Francisco Hospital, October 11, 1921. A right rectus approach was used. Adhesions were everywhere. The gall bladder was normal. Several firm glands, about the size of a lima bean, were palpable in the mesentery. One was removed for examination. Anterior gastrotomy was performed. The hand was introduced, and a soft, foul, necrotic, greyish mass of polypi about the size of an orange was delivered. The surgeon's impression was that it was a benign growth. The polypi were excised

with scissors and the base cauterized thoroughly with the actual cautery, the defect in the mucosa being closed by suture. The gastrotomy was repaired. The patient left the operating room in shock. A gradual downhill course led to death on the second day following operation.

Pathological report. Gross: The specimen consists of a large irregular mass 5.5 by 5.5 by 4 centimeters and half a dozen smaller masses. The large mass is deeply fissured, the surface in part finely nodular; projecting from the greater part of the surface are numerous fine delicate finger-like processes, so that the mass as a whole resembles coral; on section the tissue is of spongy consistency, rather soft and friable, without any apparent marked vascularity, made up of small pale brown opaque irregular areas. Included with the specimen is a small firm flattened node of 1 by 1 by 0.5 centimeter which on section shows no gross tumor involvement. Microscopic: Sections taken from the large nodule and from several of the smaller nodules show a rich papillomatous growth of which the papillæ are sometimes long and thin, at other times shorter and thicker. These are covered for the most part by a single layer of columnar epithelial cells with protoplasm taking a medium deep stain and nuclei that tend to be elongated. Some of the epithelial cells contain a single large clear vacuole in the superficial portion of the protoplasm, thus resembling goblet cells. In other places the epithelium shows a tendency to pile up into several irregular layers. Mitotic figures are everywhere numerous. In the central portions of the sections are found spaces, usually small, lined by epithelial cells similar to those covering the papillæ, the spaces frequently containing degenerating leucocytes, most of them polymorphonuclears. These may represent glandular structures though some may be cross sections of the deeper portions of crypts. The stroma of the papillæ is composed of connective tissue frequently areolar and œdematous in appearance, particularly that in the distal portions of the papillæ. Everywhere the stroma is filled with large numbers of cells, including plasma cells, lymphocytes, and polymorphonuclear leucocytes. The stroma of the central and more solid parts of the growth contains in addition some small bundles of smooth muscle fibers. In the spaces between some of the papillæ, there are leucocytes and cellular débris and also occasionally a small amount of some faintly staining material resembling mucus. Small quantities of similar material are found in the tumor stroma, particularly in the central portions. Considerable areas of necrosis are present involving chiefly the superficial surface of the growth and associated with marked fibrin formation and polymorphonuclear leucocytic infiltration, the exudate frequently extending deeply inward between the papillæ. Section through the lymph node included with the specimen shows sinuses filled with leucocytes, including numerous lymphocytes, neutrophiles, and eosinophiles. There is also a slight diffuse increase in connective tissue, but nowhere is there apparent any tumor involvement. Diagnosis: Adenocarcinoma of the stomach. (Dr. Perkins.)

Certain peculiar circumstances attend this case. There is a definite history of achylia dating back over 25 years, but at the first operation nothing abnormal was noted by palpation, except a thickening of the pylorus. There was a small, old, healed ulcer which was excised. This operation relieved his symptoms for only a short time. Nine months later, a second operation revealed enormous polypoid masses evidently of long duration. It is possible that polypoid growths had been present for 25 years, giving marked symptoms; that these were not recognized on account of their size or consistency at the first operation, and that superimposed malignant degeneration was responsible for the recent rapid growth.

CASE 2. A. R., an Italian, male, age 42 years, entered the Medical Department of the University of California Hospital on the private service of Dr. W. J. Kerr on March 5, 1924, with the complaint of weakness and "gas pains." His family history was unimportant. For 2 years he suffered burning, non-radiating pain about 1 inch above the umbilicus, coming on about 2 hours after meals and relieved by food and alkali. A few days after the onset of symptoms he passed tarry stools. Four months ago he began to vomit; the first evening he passed tarry stools; the next morning he vomited changed blood. On two occasions shortly after the attack he vomited fresh blood. Since then he has had a progressive increase in severity of epigastric pain and burning, and he has noted considerable pallor, weakness, dizziness on sudden movements, palpitation, and buzzing in the ears. He is chronically constipated and has had hæmorrhoids for a long time. He has lost 7 pounds in weight in the last 4 to 5 months. He had gonorrhœa at the age of 32. He denies syphilis. Physical examination was negative except for dental caries and pallor. The abdomen showed no masses, rigidity, tenderness, nor peristalsis. Examination of the blood showed marked hæmoglobinæmia, 34 per cent. The urine showed 7 to 10 pus cells per high dry field; with slightest possible trace of albumin. Blood Wassermann gave a 4+ reaction; spinal fluid, normal. Examination of the stools showed benzidine test positive on two occasions. Gastric analysis disclosed some gross blood in the fasting content. The passage of a tube elicits pain over the xiphoid which persists as long as tube is in. No free hydrochloric acid. On first examination the roentgenograms showed a constant irregularity in the immediate prepyloric region and greater curvature over which peristaltic waves do not pass; cap showed constant irregularity. (Dr. Thom.) On

second examination (Fig. 4) there was noted a large, indented area near the middle of the greater curvature with several polypoid growths projecting into the lumen. There was a lack of filling in the immediate prepyloric region, apparently due to polypi. Roentgenological conclusion: polyposis of the greater curvature and prepyloric region, possibly luetic (Dr. Ruggles). Two intravenous injections of salvarsan were given without marked improvement.

Dr. J. H. Woolsey was called in consultation. The patient was transfused with 500 cubic centimeters of citrated blood. The following day (March 25, 1924) he was operated upon by Dr. Woolsey, one of us assisting. The pre-operative diagnosis was gastric polyposis. Nitrous oxide anæsthesia was given. A right rectus incision was used. The abdominal contents were negative except for the stomach and a few adhesions in Morrison's pouch; the duodenum was dilated in size by about one quarter. The stomach serosa was normal. The gastric wall was thickened along the greater curvature from the junction of the distal and middle thirds to the cardiac orifice; it was not indurated but had a definite edge. There were a few small lymph glands along the greater curvature. Anterior gastrotomy made possible direct inspection of the entire mucosa, which was markedly hypertrophic and transversed by deep folds varying from one-quarter to 1 centimeter in depth. The changed areas involved the entire upper portion of the stomach, even about the cardiac orifice, in raised reddish-brown plaques of various sizes with definite edge, showing punctate hæmorrhages and superficial ulceration. The mucosa was covered with a considerable amount of mucus. Partial gastrectomy of about the middle half was performed. The affected areas in the upper quarter could not be removed, and gastro-gastrostomy was done. The patient stood the operation well and left the operating room in good condition. Postoperative course was complicated by the development of an omental abscess which was incised on the eighteenth day after operation; otherwise convalescence was uneventful and the patient was discharged May 6, 1924, much improved, with a hæmoglobin of 46 per cent and a consistently negative benzidine test in the stools. Roentgenological examination made some time after operation showed the stomach fairly normal with the operative wounds scarcely discernible; there was a small irregular area high up on the greater curvature which probably represented some of the localized hypertrophy of the mucous membrane; still some irregularity of the cap (Dr. Thom). On August 4, 1924, the hæmoglobin was 60 per cent. The patient was feeling well, tolerating a regular diet. Anti-syphilitic treatment was being continued.

Dr. Woolsey informed us in January, 1926, that the patient was symptomless and tolerated a regular diet. There was no occult blood in the stool. The hæmoglobin and erythrocyte counts were normal.

Pathological report. Gross: (See Fig. 5.) The specimen consists of a portion of the stomach wall measuring 10 by 12 centimeters. The mucosal surface is thrown into large, heavy roughened folds measuring about 1 centimeter across and projecting about 1 centimeter in height. There is only one small area on the edge of the specimen showing any semblance of normal mucosa, and here the tumor ends abruptly. The other edges seem to have been cut through the tumor mass. The surface of the tumor shows areas of dark brown discoloration, probably the site of hæmorrhages. There is some fibrinous material here and evidences of superficial ulceration. Cut section reveals a stomach wall about 2 centimeters thick divided into three layers. The mucosa is in preserved state sharply demarcated, hard, yellowish white, and about 3 millimeters in thickness. The submucosa is about 1.5 centimeters thick and is composed of loose, white, cottony material. The muscle layer is about 3.4 centimeters thick. The peritoneal surface is smooth, has some fatty attachments, but no adhesions are seen. Gross impression: Gastric polyposis (papillomatosis). Microscopic examination (Figs. 6, 7, 8) of the sections shows an exaggeration of the normal pattern of the stomach mucosa. The glands are greatly elongated. The epithelium is made up of high columnar type of cell in orderly arrangement. The chief and parietal cells at the base of the gland are clearly differentiated. The basal membrane of the glandular structures is everywhere intact. The stroma is diminished and contains many leucocytes, both mononuclear and polymorphonuclear. Diagnosis: Gastric polyposis (papillomatosis) with infection. Described by A. E. Larsen (Dr. Bartlett).

Although the impression of the microscopic picture was one of normal stomach, except for the presence of mild chronic inflammatory changes, there was noted a rather unusual increase in the number of the chief cells, which seemed to be larger and more undifferentiated than usual. For purposes of further study new sections were made from the specimen. In these Dr. Rusk found a remarkable picture of dilated spaces in the mucosa, especially toward the lumen, filled full with red blood cells, and lined with cells which strongly suggested endothelium. Special sections were prepared by Dr. Rusk, according to the method of Van Giesen, and the endothelial nature of these spaces confirmed. The raised, red areas then were not epithelial growths, but belonged to the class of telangiectasis. Telangiectasis of the stomach is a very rare condition, but not unheard of. No textbook mentions that such a condition occurs. At the present time we are not prepared to give any further data on this subject. A

similar case of polyposis was reported in 1820 by Monfalcon in which he speaks of a structure resembling that of the corpus cavernosum. It may be that some of the cases reported as polyadenome *en nappe*, were cases of telangiectasis of the stomach.

CASE 3. E. F., a German clerk, age 58 years, consulted Dr. Bertram Frohman on August 12, 1924, complaining of shortness of breath, loss of weight and strength, and swelling of the ankles. Family history showed no hereditary taint. He had one attack of gonorrhœa 3 years ago; he denied syphilis. Fifteen years ago he had an attack of "ptomaine poisoning," thought to have been due to ingestion of fish. Two years ago he had a slight attack of "biliousness," at which time he noted dark stools; since then he has had no gastro-intestinal disturbances. For several months he had been told that he looked pale. His present illness began 2 months ago when he first noticed swelling of the ankles at night, shortness of breath, and loss of strength. Fluoroscopy taken at the request of Dr. Nelsen of Oakland revealed marked filling defects on the greater curvature; one near the cardia, the other 4 centimeters below.

Physical examination was negative except for cachexia, an old lesion with occasional mucous râles at the right pulmonary apex, and functional aortic and mitral murmurs; moderate distention of the abdomen, with slight tenderness and moderate muscle guarding about 2 fingers' breadth above the umbilicus. No masses were felt. He showed a slight œdema of the ankles. Rectal examination was negative.

Examination of the blood showed hæmoglobin 40 per cent, Talquist and Sahli, erythrocytes 2,800,000. Occult blood positive was found in the stools; in the urine an occasional pus cell. Blood Wassermann gave a negative reaction. Roentgenological examination of the stomach showed two large, rounded defects near the greater curvature; one 2 inches below the cardiac opening, the other in the body of the stomach. From the X-ray examination a diagnosis was made of papillary tumors of the stomach which may be benign. (Dr. Ruggles.) (Fig. 9.)

In attempting to secure *gastric content* for analysis following an Ewald meal, fresh blood was encountered in the second specimen. On withdrawing the tube a small piece of necrotic tissue was found adherent to it. This was examined microscopically by Dr. Oliver and a diagnosis was made of papillary epithelial growth, probably malignant. There was no free acid in the specimens. Diagnosis: Cancer.

The patient entered Mt. Zion Hospital. One of us was called into surgical consultation. The roentgenograms were again inspected. They showed defects which encroached on the lumen with partial preservation of the shadow of the stomach wall. In view of our experience with the previous cases, it was thought probable that this was a case of polypi which may have been benign. A pre-operative diagnosis was made of gastric polyposis. Pre-operative preparation included an injection of 10 cubic centimeters of 5 per cent calcium chloride intravenously and 20 cubic centimeters of whole blood intramuscularly daily for 3 consecutive days. On the morning of operation, by a partially successful attempt to transfuse whole blood by the Kimptom-Brown method, 150 cubic centimeters were given. This was supplemented by transfusion of 500 cubic centimeters of citrated blood and 250 cubic centimeters of Ringer's solution intravenously given before and during the operation. Operation was performed by one of us on July 19, 1924, at Mt. Zion Hospital. Local anæsthesia was induced with one-half per cent novocain with adrenalin. Operation was done through a right midline approach. The diseased condition was confined to the stomach and to an enlarged gland about 1.5 centimeters in diameter on the greater curvature, the latter probably inflammatory. The gastric serosa was normal. Through the stomach wall could be palpated several large tumors. Further anæsthesia was induced by intra-abdominal splanchnic block. Anterior gastrotomy was performed. Nearly the entire lumen was encroached upon by large, soft, grapefruit sized cauliflower-like reddish brown tufted tumors, the surfaces of which were studded with ulcerated and necrotic areas. At first inspection, it was thought that this was one large tumor, but it was finally determined that it was composed of four closely placed tumors (Fig. 10). The largest, the size of a fist, was on the greater curvature near the posterior wall, and showed numerous necrotic and ulcerated areas. The next largest, the size of a small fist, situated only a little distal, was separated from the larger polypi by a strip of normal appearing mucosa one inch wide. A third large polyp about lemon size, and a fourth the size of a walnut rested on the lesser curvature in the fundus. There were about five small pedunculated polyps, the size of a pea, surrounding the pylorus. The intervening mucosa appeared normal. Each of these masses was removed by cautery irons, the large ones first being clamped at the base. As the clamp was removed, bleeders were ligated and the base thoroughly burned out. Defects in the mucosa were closed with suture. The gastrotomy was repaired and closure effected in the usual manner by a double row of catgut sutures and reinforcements of Pagenstecher. The patient stood the operation well. Postoperative course was complicated by a malarial infection; otherwise uneventful. Two months later, roentgenological examination showed the lower third of the stomach contracted, somewhat funnel shaped, and slightly irregular in outline; there was no actual filling defect, the stomach emptied very rapidly with a large smooth cap. The patient steadily improved, appetite became good; blood improved, but still remained below par; no gastric symptoms appeared.

Pathological report. Microscopic examination (Fig. 11) from several areas of papillomatous mass from the stomach shows in the more superficial parts a

number of relatively thin papillomatous processes covered by epithelium varying from one to several layers thick supported on a thin strand of stroma containing blood vessels, scattered lymphocytes, and plasma cells lying in a small amount of connective tissue. Farther in, the epithelial hyperplasia becomes more marked, takes on an infiltrating papillary adenocarcinomatous pattern. The amount of the stroma shows much more extensive infiltration with lymphocytes and plasma cells and in certain areas there is considerable overgrowth of fibrous tissue, at least, relatively a large amount in proportion to other portions of the growth. The epithelium forming the new-growth is of high columnar type. Where it occurs a number of layers thick, there is a tendency for secondary lumina to form. The cells stain diffusely, show sharply outlined nuclei with relatively little chromatic material, but each with a conspicuous nucleolus. Cells in mitotic division are not infrequent. Diagnosis: Papillary adenocarcinoma. (G. Y. Rusk.)

On August 1, 1925, the patient reported complete absence of gastric symptoms. His weight was about the same. Fluoroscopy showed the lower one-third of the stomach slightly contracted and a very slight irregularity of the lesser curvature just inside the pylorus, suggesting recurrent carcinoma or post-operative changes (Bryan). The stool showed occult blood on two examinations. The blood showed a very slight anæmia. The urine was normal.

August 12, 1925, he complained of slight loss of strength but no gastric symptoms. At this time his hæmoglobin was 80 per cent, erythrocytes 3,500,000. Gastric analysis again showed absence of free hydrochloric acid. Occult blood was demonstrated in the stool. Considerable improvement was secured under iron cacodylate injections and calcium lactate by mouth.

In September, 1925, he first complained of a tumor mass at the site of the operative scar. The mass was just to the left of the midline, midway between the ensiform and the umbilicus, of spherical form, measuring about 3 inches in diameter, firm, fixed and not tender, its median portion seeming to infiltrate the abdominal wall, where, as a smooth, knob-like prominence 1 inch in diameter, it could be easily seen and felt, just beneath the skin. The lateral portion was much more irregular and was gradually lost in the deeper portions of the abdomen. X-rays taken at this time by Dr. Frohman showed a large defect on the greater curvature which gave the impression of recurrence in the stomach. No gastric symptoms were present.

October 14, 1925, he again complained of weakness. Hæmoglobin was 60 per cent, erythrocytes 3,200,000. He again responded to medical treatment. No gastric symptoms were present.

December 11, 1925, he reported normal weight and physical condition.

December 23, 1925, 17 months after operation, X-rays by Dr. Lloyd Bryan showed a "large irregular defect involving the lower half of the stomach in the region corresponding to the palpable mass, probably malignancy" (Fig. 12). The patient looked the picture of health and complained of no symptoms. Although the roentgenogram and the character of the mass spoke for malignancy, it was felt that the defect noted by X-ray may well have been due to benign recurrences, especially in view of the appearance and history of the patient, and further operative procedure in the near future was contemplated.

Case 4. R. A. W. A Canadian lumberman, age 45 years, consulted Dr. Leroy Briggs complaining of stomach trouble, loss of strength, loss of appetite, vomiting, fainting spells, and dizziness. Except for the fact that his mother died of tuberculosis when he was 14 years old, his family history is of no importance. For 15 years he has consumed alcoholic beverages excessively once a week. He had gonorrhœa at the age of 22 and underwent a course of salvarsan treatment at the advice of his physician.

Except for the above he was perfectly well until one and one-half years ago, when he began to have an "all gone feeling" in his epigastrium about 1 hour after meals, associated with belching which usually relieved it. At this time he first began to notice dizziness on sudden change of position, especially on stooping over. Six months ago, nausea and vomiting were added to the above complaints. Eructations would sometimes take the place of vomiting attacks. The vomitus was extremely sour, often stringy, but he has no knowledge of ever vomiting blood or coffee ground material. He has had a craving for sour foods but their ingestion always produced vomiting. The gastric symptoms were more constant on a full stomach. Constipated for years. Never noticed tarry nor bloody stools. Since the onset of these symptoms, there has been progressive weakness. Attacks of dizziness when things turn suddenly black began about a year ago and are becoming progressively frequent. Six months ago he had an attack of glossitis lasting 2 months. He lost 16 pounds during the course of his illness, although his present weight is 6 pounds more than his weight 6 months ago.

The important physical findings were as follows: Patient was very pale, almost cachectic. The right pupil was slightly greater than the left. The tongue was normal. The chest was normal except for signs of an old process at the left apex. The abdomen was level, symmetrical, tympanitic. Except for slight tenderness over the gall-bladder region, the abdomen was normal. No masses.

Examination of the blood showed hæmoglobin 52 per cent, erythrocytes 1,750,000. The smear showed marked anisocytosis and poikilocytosis, with marked polychromasia with a fairly large number of myeloblastic cells, the whole picture strongly suggesting pernicious anæmia. The white blood cell count was 4,800, 72 per cent polymorphonuclears. The urine showed fairly numerous hyaline casts, an occasional cellular cast. The blood Wassermann was negative. Gastric analysis showed a considerable amount of mucus in the first three specimens. The fourth specimen showed a fresh blood clot, which was examined

microscopically in the hope of identifying tumor tissue, but none was found. No free acid was found in any specimen. Fasting content contained no pepsin nor renin; no tumor tissue. Microscopic examination showed red cells and occasional pus cells; no unusual bacteria. The stools were negative for occult blood. Roentgen-ray examination was made October 22, 1924 (Fig. 13). The lung fields were clear. The heart and arch were normal. The diaphragm moved well and equally. No delay was detected in the œsophagus nor regurgitation through the cardia. The stomach was in good tone; moved freely; the entire outline was rather hazy. There were multiple rounded punched-out areas throughout the gastric outline. One of these was on the lesser curvature at the upper margin of the pars media. There was another one near the lesser curvature in the pyloric antrum region. The outline of the stomach was preserved and not destroyed as would be the case in the presence of a carcinoma. The entire pyloric antrum region was deformed by finger-like projections into the lumen. The duodenal cap was of medium size and smooth in outline. Descending duodenum was normal. At 6 hours, there was no gastric residue. The 6 hour meal was in the terminal ileum and cæcum which were freely movable, separable, and not tender. From the X-ray examination a diagnosis of multiple gastric polyposis was made. (Lloyd Bryan, M.D.)

The presence of gastric achylia, fresh blood in the stomach content, the large amount of mucus, and finally the roentgen examination left little doubt that we were dealing with a case of multiple polypi of the stomach, which may have been benign.

One of us was called into surgical consultation. After inspection of the roentgenograms and in view of experience with previous cases, a pre-operative diagnosis was made of gastric polyposis. Immediately before operation patient was transfused with 500 cubic centimeters of whole blood, previously cross-agglutinated as well as typed. Operation was performed by one of us at Mt. Zion Hospital, October 30, 1924. The abdomen was entered through a straight upper midline incision, the site previously having been blocked by a local administration of one-half per cent novocain. A normal liver presented 2.5 centimeters below the costal margin. The gall bladder and bile passages were normal. The stomach was free of adhesions. The serosa was normal. Through the gastric wall could be palpated several small, soft, pedunculated masses projecting into the lumen. The splanchnics were then blocked intra-abdominally with 70 cubic centimeters of 1 per cent novocain. A linear gastrotomy on the anterior wall midway between the curvatures allowed direct inspection of the mucosa (Fig. 14). The lower third of the stomach was diffusely involved with soft, reddish brown, hazel to walnut sized growths confined to the mucosa and freely movable over the subadjacent layers, numbering 12 to 14. The highest growth, measuring about 1.5 centimeters, was situated at about the middle of the lesser curvature; the lowest was at the pylorus where there was a group of three or four. The largest growth, measuring about 2.5 centimeters in diameter, rested on the greater curvature just below its middle and displayed areas of superficial ulceration and punctate hæmorrhage. Similar areas were noted at the summits of some of the other polyps. Most were pedunculated, shaggy, and tufted; some were broad based. The intervening mucosa was thrown into somewhat hypertrophic folds separated by fairly deep furrows, with a tendency to run in a direction parallel to the pylorus. Otherwise the tumor-free mucous membrane appeared normal. The gastrotomy was then closed and the entire tumor bearing area, except the area bearing the highest polyp, was removed. This tumor was thoroughly excised, care being used to remove all its base, and the defect in the mucosa was closed by suture. The gastro-intestinal tract was then re-established by gastroduodenostomy according to the Billroth I. method. Anæsthesia was good and patient stood the operation well.

That evening the patient developed fever. Early the next morning the temperature went to 106.4 degrees by axilla and was associated with marked respiratory distress. The abdomen was surgically in good condition. There had been no vomiting nor gastric distress. The only symptom of moment had been cough with mucopurulent expectoration. (Patient had chronic bronchitis.) Chest was full of coarse râles. No signs of pneumonia were present. Patient was stuporous, respirations were rapid and labored with occasional periods of apnœa. The pulse remained good. He seemed to be dying of respiratory failure due to hyperpyrexia. A startling improvement in respiration, temperature and mental condition began 5 minutes after the use of icepacks and colonic flushes of ice. In spite of stimulation of the cardio-respiratory center by all accepted means, the temperature began to climb again, the course was progressively down hill, and death occurred on the third day following the operation. These peculiar circumstances which surrounded his death were attributed to the addition of a transfusion shock to the shock of a severe operation. There was no autopsy.

Microscopic examination (Fig. 15) has been made from the largest polyp-like mass of stomach, the one showing ulceration and also the mass that was removed separate from the main mass. Sections have also been examined from a number of lymph nodes and adjacent to the stomach certain masses of fatty tissue that felt slightly firmer than the general mass. Sections from the largest mass show superficial ulceration beneath which is a growth varying greatly in appearance in different areas; in some areas there is a more or less adenomatous structure, the epithelium of which varies from one to several layers thick, stains diffusely and fairly deeply; polymorphonuclear leucocytes occur in the gland lumina in places; the interstitial tissue shows extensive infiltration with lymphocytes, plasma cells and eosinophiles; in other areas the adenomatous appear-

ance is less marked, the glands taking on a much smaller size and are rarely replaced by solid epithelial plugs; among the epithelial cells mitosis is not infrequent; the growth breaks through the muscularis mucosa giving an infiltrating carcinomatous appearance with large acini in some places and small diffusely infiltrating ones in others.

Sections from the mass removed secondarily show, in general, the markedly adenomatous structure with great variation in the epithelium; these sections, however, do not definitely show infiltration beneath the muscularis mucosæ.

Sections from lymph nodes and fat are negative for invasion by cancerous processes. Diagnosis: Adenocarcinoma of stomach occurring in connection with multiple polypoid masses. (G. Y. Rusk.)

CASE 5. A. R. A single, American woman of 50 years, consulted Dr. T. O. Burger of San Diego on June 9, 1923, complaining of vomiting, abdominal pain, and weakness. Her family and past history were of no significance. For several years she has had gastro-intestinal complaints. At the onset there was only indefinite distress. For many months she has been losing weight and color. At the same time the distress, "like a ball in the stomach," became gradually more frequent and more severe, especially during the past 3 months and after the morning meal. More recently she has had periodic attacks of vomiting of 12 to 36 hours' duration, associated with severe abdominal pain, during which everything ingested was eventually vomited; these, too, are becoming more frequent. On one or two occasions the vomitus showed small amounts of fresh blood. She has been below her normal weight for several months and has lost 20 pounds recently.

On physical examination absolutely nothing abnormal was found except pallor. The abdomen showed nothing unusual. The gastric content was examined on two occasions (January 13 and April 18). On the first occasion the fasting content contained occult blood; free acid was absent, but ferments were present. On the second occasion the fasting content showed much blood; free acid was absent until one and one-quarter hours, when only a trace was found. The stool was positive for occult blood on several occasions. The hæmoglobin varied from 50 to 80 per cent (S). The urine showed a trace of albumin, was positive for diacetic acid and acetone and contained hyaline casts, leucocytes, and erythrocytes. The blood Wassermann was negative.

Roentgenological examination on three occasions revealed entirely different pictures. In the first, the pylorus was gaping and peristalsis practically absent. In the pars media in the greater curvature was a filling defect about 5 by 10 centimeters which had finger-like cauliflower projections involving nearly one-third of the greater curvature. The antrum and pylorus were smooth. The stomach was freely movable. The duodenal cap was normal in outline, not fixed nor tender. On the second examination, 10 days later, the stomach showed capacity diminished to 12 ounces. There was a constant filling defect of the pyloric third; and the pyloric ring, antrum, and duodenal bulb could not be clearly demonstrated at any time (Fig. 16). A fine line of barium marked the narrow isthmus through the pylorus. There was a moderate tenderness corresponding to the pyloric end of the stomach, but no mass was palpated. After 6 hours the stomach was faintly outlined with some retained barium, but most of the meal was in the terminal ileum. The patient vomited about 8 ounces of the fluid prior to the 6 hour examination. Films taken during the first examination when the patient was not vomiting showed the stomach not blocked, with polypoid masses lying quietly in the stomach. Those taken during the second examination at a time when vomiting and pain were present showed a herniation of the polypoid tumors into the pylorus, completely blocking the passage.

The patient was operated upon June 11, 1923, at Mercy Hospital, San Diego, California, by Dr. Burger. Pre-operative diagnosis (made by X-ray) was tumor of the stomach. Nitrous oxide, oxygen and ether anæsthesia was used. The abdomen was opened and explored. Pathological findings were confined to the stomach. Through the stomach wall could be palpated an irregular tumor mass in the pyloric region, the outline of which could be seen. Gastrotomy was performed through normal gastric wall, and the mass avoided. Direct examination of the mucosa revealed a number of firm, finger-like polypi of various sizes and shapes, some slightly pedunculated, others sessile, all covered with normal gastric mucosa which showed slight erosion. The polypi could be easily pushed forward so that they filled the pylorus. Each polyp was grasped and removed individually by actual cautery, care being used not to perforate the serosa. The bases were closed over with chromic catgut when deemed necessary. In all, twenty-five to thirty polyps were removed. The gastrotomy was repaired and the abdominal incision closed in the usual manner. Postoperative diagnosis: multiple polyposis of the stomach. *Microscopic report:* adenoma-fibroma. Except for a left iliac phlebitis which developed on the third day, the postoperative convalescence was uneventful. The stool was positive for occult blood in January, 1924. The patient gained weight and was free of symptoms following her operation. The result of the phlebitis was the only source of annoyance.

PROBABLE CASES

CASE 6. W. F. An American miner, of 56 years, entered the University of California Hospital April 22, 1921, complaining of abdominal pain and constipation. The mother died at age of 68 years of intestinal obstruction; otherwise the family history is unimportant. He mined for quartz 4 years, for lead and arsenic 3 years, for gold and silver 23 years. In 1912 he had "arsenic poisoning." He has had numerous attacks of tonsillitis since childhood. Otherwise his past history was not noteworthy.

The first gastro-intestinal symptoms occurred at the age of 35 when he had attacks of "heart burn"

and "indigestion," aggravated by the ingestion of steaks or fruit. For many years he has had an uncomfortable feeling in the epigastrium after meals, relieved by belching gas. About 6 months ago he began to have a full feeling in the epigastrium about 1 hour after meals, lasting 2 to 3 hours, and not relieved by food. Four months ago this changed to a burning sensation, aggravated by food. These symptoms increased in severity until 3 weeks ago when he had a sudden sharp non-radiating pain in the epigastrium about 1 hour after a meal. This left him with a dull aching pain coming on about 1 hour after meals, and lasting 3 to 4 hours, associated with considerable distention, often relieved by soda but aggravated by food and by lying on his right side. When he sits down he notices a dull ache on the epigastrium at a definite point under the costal margin just to the left of the midline, which is very tender to pressure. He has never had nausea, vomiting, hæmatemesis, bloody or tarry stools. For 3 months he has had a burning sensation in the back at the level of the twelfth thoracic and first lumbar vertebræ, not related to food or to the epigastric pain. He has been markedly constipated for years. His best weight was 164 pounds, 15 years ago; average 155 pounds; now 140 pounds.

On physical examination the following findings were noted: The pupils were unequal and irregular but reacted normally. The abdomen was slightly full in the left hypochondrium. There was considerable tenderness 3 to 4 centimeters below the left costal margin where there was faintly palpated a firm, tender mass about 3 centimeters in diameter which did not move with respiration. There was also tenderness about 2 centimeters to the left of and just between the umbilicus; the pain elicited radiated to the left hypochondrium. The liver edge was palpated 4 centimeters below the costal margin and was not tender. Rectal examination was negative. Roentgenological examination of the colon was negative.

Examination of the blood showed hæmoglobin, 70 per cent; erythrocytes, 4,600,000; leucocytes, 10,800; polymorphonuclears, 71 per cent; eosinophiles, 4 per cent. In the urine were found occasional hyaline-granular casts, occasional erythrocytes and pus cells. Gastric analysis was done on three occasions, and pus cells were found on all occasions. In each analysis the free hydrochloric acid was low; in one it was absent in the first five tubes (until one and one-quarter hours), in another it was absent in the first six tubes (until one and one-half hours), in the third it was less than three until the fourth tube. In two the total acid was low; in one it was within normal limits. Notation of ferment examination was made only once, in this case both pepsin and rennin were present. The stools were negative for occult blood on several examinations. Roentgenological examination on two occasions gave similar pictures. Fluoroscopy showed lung fields grey and apices contracted; diaphragm moved very little; stomach was of good tone and position; peristalsis slight. Patient complains of tenderness at one point of greater curvature where there seems to be some irregularity. Films showed large defect along the greater curvature. From these findings a diagnosis was made of papilloma or papillomatous carcinoma (Fig. 17).

On April 29 the patient was transferred to the Surgical Service for operation. Pre-operative diagnosis by Dr. W. I. Terry was benign papilloma of stomach.

The patient was operated upon by Dr. Wallace I. Terry on April 30, 1921. Anæsthetic used was nitrous oxide and oxygen. On the serosa of the stomach on the anterior wall of the greater curvature at the juncture of the upper and middle thirds were two firm glands about 0.5 centimeter in diameter. There were several moderately hard, reddish glands, the largest about lima bean size in the omentum. On palpation there was found an apparent mass in the stomach over the area on which the glands were seen. Gastrotomy about 3 centimeters long failed to demonstrate any polypoid condition, but the mucosa was markedly thickened and thrown into heavy folds over its entire surface. The gastrotomy opening was closed in its original direction except in the lower portion which was approximated in a direction transverse to the original incision. Two glands were removed for examination. The patient stood the operation well and passed an easy convalescence. Pathological examination of the tissue showed only lymph glands in a state of hyperplasia. Patient was discharged May 15, 1921, improved, with the diagnosis of chronic hyperplastic gastritis.

On July 23, 1924, he again reported to the Out-Patient Department complaining of sharp epigastric pains in early morning. His weight was normal. The roentgenograms were again inspected by Dr. Ruggles who stated that in spite of the operative findings, outspoken polypoid condition undoubtedly existed and will become more characteristic in time.

The patient reported by mail in September, 1925, that since the summer following his operation he has been free of any symptoms. He refused to re-enter the hospital for further study.

Case 7. A. S. An American clerk, age 41 years, whose family and past history were unimportant, entered the University of California Out Patient Department in January, 1923, complaining of dull pain in the abdomen, and nausea. Since 1920 he has suffered from gastro-intestinal disturbances. At first there was a gradual onset of fullness in the lower abdomen from 3 to 5 hours after meals, changing to a dull pain starting in the right lower quadrant and radiating to the left lower quadrant, associated with nausea and constipation, markedly relieved by vomiting and food, but aggravated by soda. He first consulted a physician in April, 1922. At that time he was passing tarry stools and roentgenological investigation showed evidence of penetrating duodenal ulcer. Under Sippy regime he had absolute, but only temporary relief, and 16 pounds weight gain. In a few months his symptoms returned and he passed bloody stools. Under dietary regime he

again was relieved, but symptoms returned whenever he went back to regular diet.

Physical examination at that time was negative except for pallor and bad oral hygiene. The urine showed pus, occasional casts, rare red blood cells, and a trace of albumin. X-ray findings pointed to a duodenal ulcer. He obtained considerable relief under a Sippy regime.

He did not report again until November, 1923. During the interim (April, 1923), he was operated upon, in a condition of shock, for a suspected perforation of a peptic ulcer, but an acute perforated appendicitis with peritonitis was discovered. After his operation he was completely relieved and was placed on a regular diet until October, 1923. Then he began to have attacks of sharp pains in the left lower quadrant, always occurring at night and sometimes awakening him, associated with slight nausea and terminating after 3 to 4 hours, with an attack of vomiting of undigested food particles. Vomiting always relieved him. In the month of October, 1923, he had seven such attacks, but no bloody nor tarry stools. His appetite was good but he lost 10 pounds during that time. He was referred to the University of California Hospital for investigation, where, except for a chronic prostatitis and postoperative ventral hernia, no additional physical findings were noted. The blood was normal. The urine showed findings as on previous examination. The stool was positive for occult blood on two occasions. Gastric analysis showed free hydrochloric acid and combined acid present in slightly increased amounts. Occult blood was demonstrated in the fasting content. The blood Wassermann was negative. Vomitus was negative for blood or tumor particles. A roentgenological study of the gall bladder was negative. Gastro-intestinal screen showed a stomach which did not canalize well. There was a large reticular defect of the middle of the greater curvature which seemed to be due to hypertrophied rugæ. Peristalsis was excessively hyperactive. The cap was small and irregular and did not fill with pressure. The X-ray findings pointed to duodenal ulcer.

On November 21, 1923, the patient was discharged with a diagnosis of duodenal ulcer, chronic prostatitis, postoperative ventral hernia and pyorrhœa.

May, 1924, he again entered the University of California Hospital. After discharge in 1923 he gained weight and was comfortable on medical treatment. In February, 1924, his weight was 130 pounds and he felt below par. The night before entry he suddenly vomited about 10 ounces of old blood. He has had no tarry stools. On physical examination, gastric peristalsis was apparent through the thinned out portion of the abdominal wall; no other significant findings. The hæmoglobin had fallen to 47 per cent, erythrocytes to 2,432,000. The urine still showed the slightest possible trace of albumin and a few pus cells. Occult blood was demonstrated in a specimen of tarry stool obtained by enema, and in a specimen passed spontaneously 6 days later.

Two weeks of rest, diet, and medication produced no noteworthy improvement. He complained of daily epigastric pain and had attacks of vomiting. His blood picture did not improve and occult blood was constantly demonstrated in the stool. He was running a daily fever which reached about 37.5 degrees C. There was marked tenderness in the epigastrium to the right of the midline with some rigidity. On June 16, 1924, he was transfused with 500 cubic centimeters of citrated, typed blood, to which he reacted severely with chill and fever. The following day he vomited three times, each time a small amount of fluid streaked with red blood. From then on there was a steady improvement in symptoms and physical condition. His hæmoglobin reached 60 per cent, red blood cells 3,400,000. The patient was transferred to the surgical service, July 6, 1924, for operation.

Pre-operative diagnosis was duodenal ulcer. Operation was performed by Dr. Woolsey. Approach was made through the old scar site. There was a characteristic ulcer on the anterior superior wall of the pylorus just distal to the pyloric vein, about 3 centimeters in diameter, with a small crater palpable through the gut wall. The first portion of the duodenum was adherent to the pancreas. Because of the patient's poor condition a posterior gastro-enterostomy only was done. In closing, the ventral hernia was repaired. The patient made an uneventful postoperative recovery. On July 23, 1924, his hæmoglobin was up to 65 per cent and red blood cells up to 3,600,000; stool was negative for occult blood. On July 26, 1924, he was discharged and told to report to the clinic for observation.

On September 29, 1924, he again entered the University of California Hospital Surgical Service. He had felt perfectly well until 3 weeks before entry. Then he began to have a dull dragging pain in the right lower quadrant, especially in the region mesad to the old right rectus scar. This pain had been present at irregular intervals, and occasionally became very acute; no relation to food, but was aggravated by activity, especially the types which cause jolting of the body. Peristaltic movements were, at times, plainly visible through the thin abdominal wall under the old right rectus incision. Blood was the same as on discharge in July, 1923. The urine was negative. On October 2, 1924, he was operated upon for repair of ventral hernia. During operation the abdomen was explored. "At a previous operation a large penetrating duodenal ulcer, that was surgically unremovable, was found with a crater extending into the head of the pancreas. At present this has entirely disappeared; there was no induration at the site of the former ulceration and the pancreas was generally firm and hardened; there was no induration at its head suggesting the presence of a crater at this time." He was discharged October 21, 1924, in good condition. Gastro-intestinal X-rays on August 28, 1924, showed a large stomach functioning well. There was unusual mottling of the fundus, especially toward the greater curvature. (Thom.)

The patient reported to the clinic on January 13, 1925, still complaining of gastric pain which had become constant. Abdominal X-ray studies showed that the barium dropped out of the stomach through the gastro-enterostomy opening immediately on entering; there was a point of tenderness exactly above the gastro-enterostomy opening. In the films (Fig. 18) the body of the stomach showed a marked irregularity in outline and density, due to excessive thickening of the mucous membrane of the stomach. The stomach shows no evidence of ulceration. The X-ray examination would indicate a diagnosis of diffuse polyposis of the body of the stomach. (Dr. Ruggles.)

In May, 1925, he complained of cramps in the region from the hernial scar to the umbilicus, of 6 weeks' duration. At times the cramps were so severe that the whole abdomen was sore. The bowels moved daily. Once or twice a week he has had a sense of gas pressure accompanied by general weakness but no nausea. He has had no pain nor burning after meals. His appetite is good. He weighs 120 pounds.

In June, 1925, he still complained of distress around the hernial scar which radiates to the umbilicus.

CASE 8. W. B., a Russian male, age 41 years, consulted Dr. W. E. Chamberlain June 25, 1923, complaining of pain in the epigastrium. His family history was unimportant. He had a small lesion on his penis at 18 years, which was treated by local applications; gonorrhœa in 1918. He used alcohol moderately. Otherwise there were no significant facts in his past history. In 1922 (1 year ago), he began to have gnawing pain about the umbilicus, 5 to 10 minutes after meals, lasting 3 to 4 hours, for periods of 1 to 2 days, with remissions of 2 to 4 days. These attacks lasted about 6 months and he then enjoyed a remission for another 6 months (until January, 1923) when the pain recurred, this time sharp in character, coming on 10 to 20 minutes after meals, lasting 30 minutes to 2 hours, brought on especially by water and beverages and aggravated by meat, vegetables, and fruit. The pain radiated around the left hypogastrium to the back, occasionally over the anterior chest when it was accompanied by slight dyspnœa. This pain had become progressively more severe and sometimes kept him awake at nights. He has had marked anorexia but no eructations. On June 1, 1923, he passed three tarry stools; did not note character of stools before nor since. The day before this he vomited. For several years he has had dyspnœa on exertion and this has become worse recently. His present weight is 174 pounds which represents 36 pounds loss in the last 7 months.

Physical examination showed dental caries, emphysematous chest; the abdomen was markedly tender in the epigastrium and there was tenderness also at McBurney's point; no organs nor masses were palpated. No other abnormal physical findings. Examination of the blood showed hæmoglobin, 85 per cent (T); erythrocytes, 5,900,000; leucocytes, 7,100; eosinophiles, 3 per cent on one occasion, ½ per cent on another. Examination of the urine on one occasion showed a trace of albumin and many pus cells; on another no albumin was found. Gastric analysis, May 31, 1923, showed a slight increase in mucus; free hydrochloric acid 14, total 30; occult blood trace. June 26, 1923, we found a considerable amount of mucus, some red blood cells, no free hydrochloric acid, total not higher than 8, occult blood positive in first, second, and fifth specimens. Sputum was negative on examination. Examination of the stool showed no occult blood nor parasites. Wassermann test on blood was negative. Roentgen-ray examination was made by Dr. W. E. Chamberlain (see Fig. 19). The gall-bladder films were negative; of the heart and lungs, negative. Films of the stomach showed it to be in good position and tone, and that it began to empty promptly. The greater curvature has a ragged appearance extending from the cardia for two-thirds of its length, and this unevenness could not be smoothed out by normal pressure. Neither was it in intimate relation with the colon. Tenderness was noted over part of the uneven area. The antrum was not spastic. The duodenum was negative. In 6 hours the stomach was empty. The barium had reached the cæcum which was movable and somewhat tender. The X-ray findings would indicate the presence of gastric polyposis. The polypi may be benign or malignant. There may be chronic appendicitis.

On June 29, 1923, an unsuccessful attempt was made to gastroscope the patient. Operation being considered inadvisable, he was discharged with a diagnosis of gastric polyposis.

CASE 9. H. S., an American harness maker, age 64 years, consulted Dr. W. E. Chamberlain, June 22, 1923, complaining of shortness of breath, stomach trouble, and dropsy. His family history was unimportant. He had typhoid fever when 10 years old; several attacks of rheumatism in the past 10 years. He denied venereal diseases. In 1882, a lower extremity was amputated following a gunshot wound.

For 20 years, he has suffered from "stomach trouble." This has often been characterized by distention and dull abdominal pain. Many times, too, after meals, he would have attacks of severe sharp pain across the upper abdomen, relieved by vomiting; these attacks would come about every 2 to 3 months and last 2 to 3 months. For many years he vomited nearly every day. Five years ago he vomited four to five times daily, and suffered with distention and sour eructations. In 1911, for the first and only time, the vomitus contained blood, and at the same period he noted tarry stools. He has had tarry stools on several other occasions, but not in the past 6 months. He has not vomited for the past 3 years. From 1914, until 4 months ago, he has been very much improved; has eaten a regular diet, has had practically no pain and very little distention. Four months ago he contracted influenza. Since then he has had aching, non-radiating

pain across the epigastrium, associated with marked distention and sour eructations coming on immediately after meals and lasting from 2 to 3 hours; no vomiting. The sensation was as if food did not pass the stomach. Appetite has never been very good. He is constipated, has had hæmorrhoids for 2 years.

For the past 30 years he has had short attacks of palpitation and precordial pain. For 5 years he has noted transient œdema of the right leg and ankle (left one was amputated). For the past year he has been short of breath on exertion. Since the attack of influenza, 4 months ago, the palpitation, dyspnœa, precordial pain, and œdema have become progressively worse and associated with cough and thick yellow expectoration which has become blood streaked in the past 2 weeks. Three months ago the œdema extended to the scrotum but on rest in bed, it was much improved until 10 days ago, since when it has become steadily worse.

For many years he has had pain over the kidneys and in the urethra during micturition. Several times he has had attacks of urinary retention lasting 1 to 3 days, during which he dribbled. For 20 years he suffered with nocturnal enuresis and has had to void 2 or 3 times; lately he has voided 4 to 5 times at night and has had considerable day frequency. He never passed calculi.

Physical examination shows a poorly nourished, cyanotic patient with rapid respiration, and slight deafness in left ear. The right pupil is slightly larger than the left; neither reacts to light but both slowly to accommodation. He has dental caries. Examination of chest by Dr. Hewlett showed the backs hyperresonant except at the right base where there is a definite area of dullness accompanied by diminished breath sounds. Scattered coarse bronchial râles are heard throughout the back. Examination of the heart shows the point of maximum impulse in the fifth interspace, 1.5 centimeters outside the mid-clavicular line. Just outside the point of maximum impulse and extending into the lower left axilla there are numerous sharp crackling râles on respiration, probably friction sounds. The heart sounds are clear, but there are at times crackles synchronous with the heart beat, presumably a pericardio-pleural friction rub. Blood pressure 150–105. Some tenderness is found over region of the left kidney. The abdomen is otherwise negative. One gains the impression of a respiratory infection and chronic nephritis. Examination of the extremities shows a moderate pitting œdema of the right foot and ankle. Amputation was done at the middle of the left thigh. Ophthalmic arteries are slightly small and tortuous. There are no other nephritic signs. The discs are normal. Electrocardiograph is normal. Genito-urinary examination discloses no present evidence of infection in the genito-urinary tract. The prostate and its secretion are normal. There is no active inflammatory or degenerative lesion present in the kidney, only hyaline casts being present, which would suggest a renal arteriosclerosis or a congested kidney. (Addis.)

Examination of the urine shows a heavy cloud of albumin, a few leucocytes. The phthalein output the first hour is 10 per cent, the second hour 10 per cent. Examination of the blood shows hæmoglobin, 80 per cent; red blood cells, 5,120,000; white blood cells, normal. The Wassermann test gave a negative reaction. Blood urea is 36.75 milligrams per 100 cubic centimeters. The stool shows no occult blood. Gastric analysis shows some mucus; no free acid in fasting content; highest free acid 10, in second specimen, highest total 17.5 in first specimen. Roentgenograms of the chest show an old pulmonary and pleural infection, probably tuberculous. The heart is much enlarged to the right and left; suggests aortic rather than mitral disease. (Dr. Newell.) Fluoroscopic examination of the heart and lungs negative (Fig. 20). The stomach was not empty at beginning of fluoroscopy but was in good position and showed marked antral spasm and irritability. Peristalsis is fair. The stomach begins to empty late, but then the barium goes through the pylorus in an apparently normal manner, filling a normal duodenal cup. After 6 hours, a large residue is present in stomach. The barium has reached the descending colon. The abdomen is tense and somewhat tender, so that mobility cannot be demonstrated. The cæcum and ileum show nothing remarkable. After 24 hours there is still a large residue in the stomach. Only a small amount of barium remains in the colon. Re-examination after 15 hours' fast, preceded by gastric lavage, shows the stomach again not quite empty but in much better condition for examination. This more satisfactory filling demonstrates some large, irregularly rounded, filling defects over the upper portion of the greater curvature. The stomach is again seen to empty normally in certain positions and at certain times. I consider the filling defects in the greater curvature typical of gastric polyposis. This may be a sarcoma. The spleen is enlarged to a moderate degree. (Newell.)

On July 1, 1923, the patient refused œsophagoscopy and was discharged in fairly good condition. During the stay in the hospital, the temperature was normal.

CASE 10. Mrs. J. C., a Spanish housewife, age 64, entered the University of California Hospital, November 15, 1923, complaining of shortness of breath, swelling of feet and ankles, cramps in legs, and "rheumatism." Ten brothers and sisters died in infancy of "stomach trouble." One brother died of "tumor of brain"; one uncle and one aunt died of "cancer." The patient was subject to frequent attacks of tonsillitis; had chorea at the age of 14. Otherwise her family and past history were irrelevant.

For 12 years patient has suffered from symptoms referable to her gastro-intestinal system. She has been subject to frequent attacks of "dyspepsia," and occasional burning and slight pain in epigastrium which radiated to both scapulæ. Although she desired to eat, she feared to do so because of the discomfort which it provoked. In addition to this

she had attacks of vomiting, or merely nausea or eructations, sometimes occurring immediately after meals, at other times several hours after. She has never had tarry stools nor diarrhœa. She has had polyuria and nocturia (7 times) for the past 3 to 4 months.

Two months ago she contracted an acute upper respiratory infection. At the onset she vomited, and for the first time noted that the vomitus was blood streaked. On several occasions thereafter she had blood streaked vomitus. Two days later she noticed that her ankles, which for 8 months had been the seat of mild œdema, were markedly swollen up to the knee, and have remained so to the present time. During the past 2 months she has had gradually increasing shortness of breath, palpitation and a non-productive cough; and she has noted a feeling of weight in the epigastrium. Her best weight was 150 pounds 12 years ago; it diminished to 109 pounds 3 years ago and struck an average of about 110 pounds. She now weighs about 122 pounds.

Physical examination showed old mitral disease, marked pallor, signs of mild fibrous changes at the apex of the right lung, and marked œdema of the extremities. There was a slight suggestion of a mass in the left upper quadrant of the abdomen and at one time the stomach could be easily palpated and its peristalsis observed. Rectal examination was essentially negative. Pelvic examination indicated that the patient probably had a panhysterectomy and bilateral salpingo-oophorectomy. Examination of the blood showed hæmoglobin, 50 per cent (Talquist); red blood cells, 2,720,000; Wassermann, negative. The urine was negative. Blood chemistry within normal limits. Phthalein within normal limits. The stools were negative for occult blood and parasites. Gastric analysis showed microscopic blood in the fasting content, no free hydrochloric acid; total hydrochloric acid, 25; many polymorphonuclear leucocytes. Vomitus was positive for occult blood.

Roentgen examination made by Dr. Thom, on November 19, 1923, showed a marked filling defect with ragged margins involving the whole middle portion of the stomach (Fig. 21), more extensive on the greater curvature; also some involvement well up into the cardiac portion. Films showed the irregularity to involve the distal half of the greater curvature with filling defects in the cardiac and pyloric portions. From the roentgen findings gastric carcinoma was diagnosed. Five days later after the patient had been saturated with belladonna, additional examination showed, during filling, a large defect as of a single large mass occupying the greater part of the fundus. There was irregularity and some stenosis of the pyloric portion mostly in the greater curvature. After 6 hours there was one-quarter gastric residue about half of which was in the fundus above the large mass, the rest in the prepyloric region with small, irregular collections throughout. Films showed a large filling defect involving practically the whole fundus. From the later films carcinoma of the stomach with polypoid growth was diagnosed (Dr. Thom).

On November 25, 1923, the patient vomited a piece of tissue. This was examined microscopically by Doctors G. Y. Rusk and E. I. Bartlett. Sections showed a fairly orderly arrangement of gland spaces lined by a single layer of cuboidal epithelium, which shows a moderate amount of metaplasia. These epithelial spaces are sometimes oval, sometimes irregular, and have a tendency to form secondary pockets. The lumina are filled with mucoid material, and some contain large amounts of exudate consisting of polymorphonuclear leucocytes and lymphocytes in large numbers, to which in many lumina is added fresh blood in variable quantities. These gland spaces are supported by a fairly well developed connective tissue which likewise is densely infiltrated with cells similar to those found in the lumina, and with fresh blood. The vessels are distended with blood. Toward the surface one finds considerable acute destructive reaction, evidenced by the desquamation of the glandular epithelium, the destruction of the epithelial cellular morphology, the large amount of œdema, and the large number of inflammatory cells. There is no definite evidence that this tissue is malignant although the question of invasion beyond the mucosa cannot be settled in the absence of submucosal tissue in the specimen.

The patient was then given X-ray therapy with considerable improvement. Œdema of the extremities subsided, vomiting ceased; but there was still occasional nausea. On December 9, 1923, the patient was discharged from the hospital with the diagnosis of gastric polyp, with malignant degeneration, with possible metastasis about the vena cava; chronic mitral valvulitis.

She reported at intervals to the Out-Patient Department. In February, 1924, she passed blood for 2 days after eating meat. In March, 1924, she complained of nausea and epigastric distress. At this time additional roentgen examination showed no change. In June, 1924, the patient complained of weakness, in October, 1924, of dizzy spells which were only transient. In June, 1925, there was a gradual improvement in symptoms and physical condition. In August, 1925, the patient complained of anorexia and breathlessness. She also had pains in her lower abdomen which were irregular in onset but more constant after eating. She reported that in the early part of August she vomited blood and mucus. X-rays taken at this time suggested polyposis. Her hæmoglobin was up to 67 per cent. Her erythrocyte to 4,440,000.

In September, 1925, she complained of much discomfort in the epigastrium. She was on a diet consisting mostly of milk. The X-rays showed no change since the previous examinations. On further examination of the films, however, Dr. Ruggles feels that the well defined rounded defects, separated so widely, the normal peristalsis, and the lack of irregularity on the curvatures make the diagnosis of polyposis unquestionable, this being substantiated by improvement following 2 years of X-ray therapy.

November 11, 1925, the patient entered the University of California Hospital, referred from the Out Patient Department for ascites, weakness, œdema of the extremities, and return of her previous symptoms. She complained that for the past 6 months she vomited immediately after breakfast almost every morning; also occasionally vomited after dinner. Vomitus was several times blood streaked and sometimes contained blood clots. She complained often of sour stomach, gas, and abdominal distress. Recently her abdomen felt "tight" and she had some tenderness in the midepigastrium referred to the small of the back; also had suffocating feeling over heart. No bloody nor tarry stools.

Physical examination showed her to be only slightly pale, not sick looking, and not having the appearance characteristic of malignancy. Her weight was 130 pounds. The conjunctivæ showed a possible slight icteric tint. There was slight dullness and diminished breath sounds at both lung bases posteriorly. Her heart is the same as on previous examination. The abdomen was distended and tense. There is a slight shifting dullness. The liver is enlarged to 12 centimeters below the costal margin in the mid-clavicular line, irregular, and knob-like at borders and over the anterior surface. Dr. W. J. Kerr felt that there were possible metastases in the omentum which was rolled up over the liver, giving the nodular feel. The spleen was firm, smooth, enlarged, and was felt 4 to 5 centimeters below the costal margin. Some midepigastric tenderness was elicited. There is a pitting œdema of the lower extremities. Pelvic examination discloses the same findings as on previous examination. Rectal examination was negative.

Examination of the blood showed hæmoglobin, 64 per cent; erythrocytes, 3,250,000; leucocytes, 15,600; neutrophiles, 78 per cent; blood Wassermann was negative. Examination of urine showed slightest possible trace of albumin; no bile, urobilin, melanin nor Bence Jones protein; 3 to 10 pus cells per high dry field. Examination of the stool showed a few fine blood streaks; benzedine+; many pus cells. Gastric analysis showed fasting content neutral; occult blood present; no free hydrochloric acid, total acid 10; 10 to 20 red blood cells and white blood cells per high dry field; no Boas-Oppler bacilli nor sarcinæ.

On November 13, 1925, she vomited. The vomitus contained many pus cells. On the same date paracentesis abdominis was performed, and 1275 cubic centimeters of greenish yellow fluid was obtained. The ascitic fluid had a specific gravity of 1008. Albumin heavy trace. Rivalta negative. Microscopically, 3 to 5 pus cells; occasional erythrocyte per high dry field. Wassermann was 4 plus in 0.5 dilution, but negative in higher dilutions. Culture showed no growth.

Roentgenograms were made of the chest and abdomen, November 12, 1925. The lungs showed increased markings which may have been due to early metastatic malignancy. The right diaphragm was high. There was a small effusion at the right base. The liver was somewhat enlarged. On November 17, 1925, roentgenogram showed the right diaphragm high and irregular in outline with considerable change from examination 5 days ago. The liver was enlarged (Dr. Ruggles).

During the stay in the hospital patient ran a daily intermittent fever to 38 degrees for the first 9 days, then her temperature dropped to normal.

On November 22, 1925, she was discharged, not improved, with the diagnosis of gastro-intestinal malignancy with abdominal metastases. It was by no means proven that a malignant condition existed here, and the appearance of the patient, the long duration of the disease, and the lack of progression as shown by roentgenogram favor strongly the impression of benign growths, although recent malignant degeneration may have supervened.

Case 11. E. N., a Finnish laborer, age 33 years, entered the University of California Medical Out Patient Department, April 6, 1925, complaining of abdominal pain after meals, nausea, and weakness. His family history was unimportant. Except for one attack of gonorrhœa 1 year ago, his past history is irrelevant. For about 3 months, he has had epigastric distress and soreness after nearly every meal, associated with gas. During this time he has had frequent attacks of nausea and headache, and occasionally has vomited. He never had hæmatemesis, nor bloody or tarry stools. Except for slight tenderness just above and to the right of the umbilicus his physical examination was negative.

Laboratory investigation showed normal findings in the blood and stool. The blood Wassermann was negative. Gastric analysis revealed nothing unusual; the free and combined acidities were within normal limits. The roentgenological findings of the stomach (Fig. 22) however, were extremely significant. There was a marked irregularity of the greater curvature suggesting a diffuse polyposis (Ruggles). Three weeks later, on second examination, the irregularity of the greater curvature was confirmed to be characteristic of diffuse polyposis (Ruggles). This patient has improved considerably under medical treatment.

The following interesting case, Case 12, came under our care after this paper was in the hands of the printer. The history, symptoms, and X-ray findings were so characteristic that in sending the report along to be included in the series we felt that this case was practically positive even though operation had not been performed and no pathological specimen obtained.

Since then this patient has been operated upon and we were confronted with an entirely unexpected condition which we find it difficult to classify.

The history of the case follows:

CASE 12. E. K. A married, American female nurse, age 30 years, consulted Dr. Bertram Frohman with the complaint of upper abdominal pain, regurgitation, diarrhœa, headaches, and dysmenorrhœa. Dr. Frohman made the diagnosis and has kindly allowed us to use his history and reports. Her family history was unimportant. In childhood she had three attacks of chorea; also was subject to bilious attacks and vertigo. She had influenza twice, 5 and 3 years ago. Menses have been irregular and their onset very painful. Otherwise her past history was irrelevant.

For 10 to 12 years she has had disturbances relative to her gastro-intestinal system. For this long period she has been subject to "indigestion," "gas," and diarrhœa. The last has been a prominent symptom, often occurring about 2 hours after meals, preceded by a griping sensation and associated with tenesmus. The stools were watery, small, sometimes as many as thirty in one day, and occasionally bloody, but never tarry. Her other symptoms were inconstant and had no definite relation to foods nor meals, although she noted them more constantly after meals. In addition, she has had attacks of pain in her right upper abdomen, varying from a sense of fullness and pressure, as of a "ball under the ribs," to knife-like pains; and also "neuritic" pains in the right scapular region.

Three years ago, following an attack of influenza, her gastro-intestinal symptoms became more pronounced and were associated with dull pains in the right lower abdomen, nausea, regurgitation, and vomiting. Gastro-intestinal X-rays taken at this time were negative. The symptoms were ascribed to appendiceal involvement. One year later laparotomy was performed by Dr. Waldeyer at Mt. Zion Hospital, and a subacutely inflamed, adherent appendix was removed. Exploration of the pelvis was negative except for a small uterine fibroid which was also removed. The gall bladder was normal. No mention was made of palpation of the stomach.

Following appendectomy the distention was considerably improved, but she still suffered from the pain, indigestion, gaseous distention, nausea, vomiting, regurgitation, and diarrhœa which preceded her operation. Because of the inability to locate a definite seat for the pathological condition, she was branded as a case of gastric neurosis.

Her physical examination was essentially negative except that moderate pressure just above and to the right of the umbilicus caused a desire to regurgitate. No tenderness nor abdominal masses were found.

Laboratory investigation showed normal urine. In the fæces the presence of occult blood was strongly positive on two different occasions. Gastric content showed large amount of mucus; no free hydrochloric acid; total acidity, 20; no gross blood. The blood showed a mild secondary anæmia.

Roentgenological examination showed the lung fields clear; heart and arch, normal; diaphragm moves well and equally; no delay in the œsophagus or regurgitation through the cardia. The stomach is high; of good tone; moves freely; and peristalsis is moderate. All along the greater curvature extending from the middle third to the cardia and to a lesser degree along the lesser curvature there are multiple small finger-like indentations extending into the barium mass. (Fig. 23.) Antrum and pylorus smooth. The duodenal cap is of medium size and smooth in outline. Descending duodenum is normal. At 6 hours there is no gastric residue. The head of the 6 hour meal is well around into the descending colon. Terminal ileum and cæcum are freely movable, separable and not tender. At 24 hours the colon is practically empty. An opaque enema shows that the pelvic colon fills readily and rises well out of the pelvis. The enema flows freely around to the cæcum. No evidence of defects or diverticula are visible. No evidence of gall bladder shadow or stones are shown on the plain films. Cholecystography shows a normal sized gall bladder of uniform density which moves freely. From the X-ray findings a diagnosis was made of diffuse polyposis. (Lloyd Bryan.)

Operation was performed at the Mt. Zion Hospital on May 19, 1926, under local anæsthesia with 0.5 per cent novocain, along with nitrous oxide and oxygen toward the end of the operation. A slightly enlarged stomach was exposed through an upper midline approach. Its serosa was free of adhesions. On palpation we were surprised to find that we could feel through the stomach wall no definite masses such as the X-ray led us to believe were present, especially along the greater curvature. On more careful palpation we did feel that the mucosa was thickened, but remarked that in a cursory examination of the stomach any pathological condition within it would have been overlooked. A long transverse incision was made through the anterior wall of the stomach. On examination of the mucosa we were confronted with a condition which was far different from what we were led by the history, laboratory, and roentgenological findings to expect. There were no discrete tumors, sessile or pedunculated. The exploring hand entered the stomach and grasped a handful of reddish, congested mucosa which could be actually withdrawn through the gastrotomy incision (Fig. 24). On further examination it was noted that this condition was the result of a marked hypertrophy of the mucosa thrown into enormous folds of various sizes, some 7 to 9 centimeters in height, higher than in any of the cases reported in the literature. The mucosa was freely movable upon the submucosa. This hypertrophy involved, principally, the upper and middle thirds of the greater curvature and the upper third of the lesser curvature. The pyloric third and the lower two-thirds of the lesser curvature were unaffected, the mucosa here being of normal appearance and consistency. There was no evidence of ulceration on the greater curvature. Two firm and purplish areas, showing evidence of recent hæmorrhage we feel, were not produced by our manipulation. The mucosal surface was not covered by an abnormally great amount of mucus.

Between the normal and the hypertrophic mucosa there was no definite line of demarcation, but one merged gradually into the other. At operation we felt that this condition did not conform to either the polyadenoma polypeaux or polyadenoma *en nappe*, but to the class of hypertrophic gastropathies, the result of chronic gastritis. Specimens were taken from this exuberant mucous membrane at different points.

When we came to close the incision of the stomach we found it impossible to do so without removing a considerable portion of the mucosa which now prolapsed out of the incision. We made no attempt, however, to remove this entire area of reduplicated mucous membrane. Patient has made an uninterrupted recovery to date.

The specimen removed was examined by Dr. G. Y. Rusk of the Pathological Department of the University of California Hospital and is as follows: Microscopic examination (Figs. 25, 26, 27) of mucous membrane of the stomach shows distinct thickening; the surface epithelium is normal. The surface presents occasional shallow clefts. The glands are tortuous and lined by normal epithelium. Parietal cells are found in small numbers near the base of a few glands. Some of the glands in the deeper portion of the mucous membrane are dilated into small cysts. The muscularis mucosæ forms a practically straight line. The reaction in the interstitial tissue is perhaps of relatively more importance. This consists of an œdema, somewhat more marked near the surface but extending through all the layers of the mucous membrane, dissecting the fibers of the muscularis mucosæ, and into the fragments of the submucosa present in the specimen. This œdema is associated with a more or less spotty infiltration by a varying number of plasma cells, frequent eosinophiles, and occasional large undifferentiated mononuclear cells. This infiltration extends in moderate degree through the muscularis mucosæ. In other regions of the mucous membrane, the stroma is extensively infiltrated with focal hæmorrhages. Near the areas of hæmorrhage and also in the upper portions of the mucous membrane and in the submucosa, the vessels are conspicuously dilated. No evidence of fibrosis is seen. Lymphoid nodules showing no abnormality except possibly separation of the cells by the general œdema, occur at different points. Diagnosis: hypertrophic gastritis.

This case is so unusual that it deserves comment. All the clinical, laboratory, and roentgenological findings seemed to make the diagnosis definite for gastric polyposis. It is easy now to understand how the bismuth meal as it entered the stomach and passed along the various reduplications of mucosa and into the depressions between them produced the picture that it did on the X-ray plate. We will, therefore, in the future have to be extremely careful in making an absolute diagnosis of this condition from the roentgenological findings.

Pathologically Dr. Rusk believes that the best descriptive term for this condition would be hypertrophic gastritis. It may be that in time a polyposis will develop on this redundant, hypertrophied, infiltrated, and œdematous mucosa.

It is also interesting that this patient has had a persistent absence of free hydrochloric acid in spite of the fact that there was present a very excessive amount of secreting mucosa.

SUMMARY

1. Diffuse gastric polyposis is seemingly a rare disease since we have only been able to collect 84 cases from literature. However, these figures probably do not represent the true incidence of the disease.

2. Gastric polyposis may be either congenital in origin or arise from an inflammatory basis. It is of great interest that these tumors have been reproduced experimentally.

3. Gastric polyposis may appear either as distinct polyps, adenomatous in nature, or as slightly elevated hypertrophic plaques *en nappe* variety. We believe that the latter may be telangiectatic in origin.

4. The symptoms and physical signs are not characteristic. Achylia is the most significant finding; combined with fresh blood and abundant mucus it should suggest the diagnosis.

5. The roentgenogram properly interpreted is the most valuable diagnostic aid. Gastroscopy and the examination of shreds from gastric washings are useful diagnostic factors.

6. Malignant degeneration occurred in 12 per cent of the 84 cases collected.

7. The treatment is surgical.

8. Our last patient, Case 12, definitely proves that the final diagnosis of gastric polyposis must be made by direct inspection at operation; that the other criteria—symptoms, laboratory findings and X-ray are not conclusive.

9. It is of interest that in our own and in the collected series no case of pernicious anæmia has developed in spite of continued achlorhydria. In our series 1 case lasted 25 years.

PROVED CASES OF GASTRIC POLYPOSIS—1820-1925

Case No.	Author	Date reported	Method of diagnosis	Age of patient	Age when symptoms began	Sex	Excessive alcohol	Hereditary polyposis	Symptoms: Pain	Anorexia	Nausea	Vomiting	Diarrhea	Hematemesis	Weakness	Constipation	Physical Signs: Tumor	Tenderness	Rigidity	Anemia	Gastric Analysis: Free HCl	Total HCl	Ferments	Blood	Tumor tissue	Mysorrhea	Occult blood-stool	X-ray	Treatment	Course	Part Involved: Upper ⅓	Middle ⅓	Lower ⅓	Greater curv.	Lesser curv.	Ant. wall	Post. wall	No. of tumors	Diagnosis	Malignant degen.	Chronic inflam.	Coincident involv.	Remarks
1	Rullier	Before 1830	P.M.																												+	+	+	+	+	+	+	80	Hypertrophy				Quoted by Andral.
2	Andral	1830	P.M.																														+						Many	Polyadenome en nappe			+	
3	Andral	1830	P.M.																													+	+					7	Hypertrophy		○		
4	Cruveilhier	1833	P.M.																												+	+	+	+	+	+	+	40	Hypertrophy	○			
5	Cruveilhier	1833	P.M.																														+						Many					
6	Cruveilhier	1833	P.M.	60		F			○	○	○	○	○	○																								12					
7	Cruveilhier	1833	P.M.																												+	+	+	+	+	+	+	95	Hypertrophy	○			Quoted by Brissaud.
8	Ripault	1833	P.M.																												+	+	+	+	+	+	+	Many					
9	Cruveilhier	1830	P.M.																												+							10					Quoted by Rosenbach and Disque. Gastric retention.
10	Richard	1846	P.M.	51		M							+													+							+	+				50		○			
11	Leudet	1847	P.M.	52		M	+		○			○	+		+																+	+	+	+			+	+	150–200	Hypertrophy	○			
12	Cornil	1863	P.M.	75		F			+			○	○																				+	+					5–6					Complete pyloric obstruction.
13	Cornil	1864	P.M.	65		F							+		+																			+					8–10			+		
14	Ebstein	1864	P.M.	77		F			○	○	○	○	○	○		○																+						+	Several					
15	Ebstein	1864	P.M.	66		M																												+					7					
16	Ebstein	1864	P.M.			M																												+					Many					
17	Ebstein	1864	P.M.	31		F																				+							+					+	Several			+	
18	Ebstein	1864	P.M.	36		M																												+					Many			+		Amyloid degeneration of viscera.
19	Ebstein	1864	P.M.	68		M																												+	+				Many					Arteriosclerosis.
20	Ebstein	1864	P.M.	44	42	M				+			+																					+	+	+	+			Many					Amyloid spleen, liver, kidney.
21	Ebstein	1864	P.M.																															+	+	+	+	+	+	+	Several					

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PROVED CASES OF GASTRIC POLYPOSIS—1820–1925—*Continued*

Case No.	Author	Date reported	Method of diagnosis	Age of patient	Age when symptoms began	Sex	Excessive alcohol	Hereditary polyposis	Symptoms: Pain	Anorexia	Nausea	Vomiting	Diarrhœa	Hæmatemesis	Weakness	Constipation	Physical Signs: Tumor	Tenderness	Rigidity	Anæmia	Gastric Analysis: Free HCl	Total HCl	Ferments	Blood	Tumor tissue	Myxorrhœa	Occult blood-stool	X-ray	Treatment	Course	Part Involved: Upper ⅓	Middle ⅓	Lower ⅓	Greater curv.	Lesser curv.	Ant. wall	Post. wall	No. of tumors	Diagnosis	Malignant degen.	Chronic inflam.	Coincident involv.	Remarks
44	Verse	1903	P.M.	15		F																														Large number				Pulmonary tuberculosis.
45	Verse	1905	P.M.	76		F																									+					Several				
46	Verse	1905	P.M.	53		M																												+	+	+	7				Pulmonary tuberculosis.
47	Menetrier and Clunet	1907	P.M.	52	27	M	+			○	+			+	+		-			+											+					Many	Polyadenome polypeaux		+	○	
48	Menetrier and Clunet	1907	P.M.	62		F				○	○	○	○	○	○																					5	Polyadenome polypeaux	+	+		
49	Michel	1907	P.M.	58	57	F				+	○			+			+														+	+	+	+	+	+	+	30	Adeno-polyp		+		
50	Wegele	1909	Operation	59	30	F				+				+	+		+				○				+				Gastrotomy, gastro-enterostomy Biopsy	Occult blood in stool after 1½ yrs. No cachexia	+	+	+	+	+	+	+	Large number	Polyposis adenomatosa ventriculi	○		?	Tumor on stomach tube.
51	Winternitz and Boggs	1910	P.M.	65		M	+			○	○		+		○		○	○	○												+	+	+	+	+	+	+	Large number	Adenoma		+	+	Associated with multiple subcutaneous hæmangioendothelioma and multiple lymphangioendothelioma of intestines.
52	Chosrojeff	1912	Tumor in washout	36	34	M	+	○	+	+	○	○	+			+	+	+			+	○	3		+	+	+	+		Excision of some. Cautery	No blood in stool or pain after 1 mo.	+	+			+	+	+	Large number	Adenomatous polypi.	+			Tumor tissue expressed on 2 occasions; 8 tumor bits first time.
53	Myer	1913	Polyp in washout				○	○	+	+			+	+	+	+	○		+	+	○	○	○	○	+	+	+	+	Obliteration of pylorus and pars media			+	+	+	+	+	+	+		Polyadenoma	○	+	○	Invagination of pylorus by polyp. Polyp in stool. Visible peristalsis.
54	Meulengracht	1913	P.M.	82		M	+			○	○	○	○	+			+														+	+	+	+	+	+	+	30–40	Polyposis ventriculi	○	+	○	
55	Meulengracht	1913	P.M.	66		F					○		○	○			+														+	+	+	+	+	+	+	300–400	Polyposis ventriculi	○	+		Atrophy.
56	Stewart	1913	P.M.																												+	+		+		+	+	Numerous	Adenomata	○			Associated with carcinoma.
57	Lamb	1914	P.M.	30		M				○	+		+				○																									

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PROVED CASES OF GASTRIC POLYPOSIS—1820–1925—*Continued*

Case No.	Author	Date reported	Method of diagnosis	Age of patient	Age when symptoms began	Sex	Excessive alcohol	Hereditary polyposis	Symptoms: Pain	Anorexia	Nausea	Vomiting	Diarrhœa	Hæmatemesis	Weakness	Constipation	Physical Signs: Tumor	Tenderness	Rigidity	Anæmia	Gastric Analysis: Free HCl	Total HCl	Ferments	Blood	Tumor tissue	Myxorrhœa	Occult blood-stool	X-ray	Treatment	Course	Part Involved: Upper ⅓	Middle ⅓	Lower ⅓	Greater curv.	Lesser curv.	Ant. wall	Post. wall	No. of tumors	Diagnosis	Malignant degen.	Chronic inflam.	Coincident involv.	Remarks
71	Eliason and Wright	1925	P.M.	50		M																												+		+		Adenomata	+	+		Gastric symptoms (nature not given).
72	Eliason and Wright	1925	P.M.	69		F																										+	+					Papillomata				
73	Eliason and Wright	1925	P.M.	71		M																															Many	Papillomata				Scattered.
74	Eliason and Wright	1925	Operation	25		M																								+	+	+	+	+	+	+	Many	Papillomatosis				
75	Eliason and Wright	1925	P.M.	60		M																					For œsophageal stricture			+		+					Many	Polyposis				Tertiary syphilis.
76	Eliason and Wright	1925	P.M.	69		M																										+					3	Polypi				
77	Eliason and Wright	1925	P.M.	58		M																										+					Several	Polypi				
78	Eliason and Wright	1925	P.M.	60		M																										+					Several	Polypi				
79	Eliason and Wright	1925	P.M.	42		M																										+					Several	Polypi				
80	Brunn and Pearl	1926	X-ray	62	37	M	○		+	+	+	○	○	+	+	+	○	+	+	+	○			+			+	Filling defects	Excision. Cautery	Shock. Death		+		+				Adenocarcinoma	+	+	○	Chancre aet. 32. Achlorhydria for 25 yrs.
81	Brunn and Pearl	1926	X-ray	42	40	M	○		+	○	+	+	○	+	+	+	○	○	○	+	○			+	○		+	Filling defects	Partial gastrectomy	Well 14 mo. p. o. Hb. normal	+	+		+	+	+	+		Teliangectasis	○	+		Blood Wassermann +++
82	Brunn and Pearl	1926	X-ray	58		M	○		○	○	○	○	○	○	+	○	○	○	○	+	○			+	+			Filling defects	Excision. Cautery	Symptomless 17 mo. p. o. but palpable mass in epigastrium and large defect by X-ray. Hb. 80%		+	+	+	+	+	+		Adenopapillomatosis	+			Cachectic before operation. Normal appearance 17 mo. later.
83	Brunn and Pearl	1926	X-ray	45	42	M	+		+	+	+	+	○	○	+	+	○	○	○	+	○		○	+	○	+	○	Filling defects	Partial gastrectomy	Death with hyperpyrexia		+	+	+	+	+	+	14	Adenopapillomatosis	+		○	
84	Brunn and Pearl	1926	Operation	50		F	○		+			+	○	+	+		○	○	○	+	○		+			+	Filling defects	Excision	Well 1 yr. p. o. but occult blood in stool			+					25–30	Adenoma	○			Intermittent complete pyloric obstruction.

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THE PRODUCTION OF ARTIFICIAL PLEURAL ADHESIONS

An Experimental Study[1]

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On the presence or absence of pleural adhesions hinges the entire treatment of suppurative conditions of the lung. When a lung abscess has to be opened through an unobliterated pleura, provisions must be made to guard against the complication of open pneumothorax and a wide-spread empyema. However, when adhesions have formed between the two pleural layers, the opening of a lung abscess is a simple matter and takes on the aspect of a subcutaneous abscess. Thus, it is not surprising that much work has been done in an attempt to find some simple method for the formation of pleural adhesions. That no such method has been found up to the present is the consensus of opinion of all surgeons interested in thoracic work, although innumerable methods have been advocated for this purpose. It has been the purpose of this experimental study either to find some new method of forming pleural adhesions, to revise one or any of the methods in use, or to determine which of the common methods is most satisfactory.

The methods in common use for the formation of pleural adhesions fall into four main groups. The first is effected by placing packing against the unopened parietal pleura either in the intercostal space or after a resection of one or more ribs. This method is unsatisfactory because it is uncertain, pleural adhesions resulting in some few instances. A pleural exudation often occurs. The second method consists in actually suturing the lung to the chest wall. The drawbacks of this method are that in the presence of a suppurative condition of the lung a suppurative focus is apt to be opened and a more or less localized empyema result. Furthermore, there is danger that during a violent paroxysm of coughing the patient may actually tear the lung at the site of the stitches and produce a pneumothorax. A third method consists in scarifying the parietal or visceral pleura after a thoracotomy. This method is unsatisfactory because adhesions do not always follow this procedure, because of the danger of hæmorrhage and, if the visceral pleura is scarified, because of the danger of injuring the lung with a resulting pneumothorax. The fourth and probably most satisfactory method consists in opening the chest wall and inserting a large pack between the visceral and parietal pleura. As usually practiced, this method is unsatisfactory because of the danger of an infection traveling through the external wound into the thoracic cavity or because of the likelihood of a pleural effusion due to the large amount of packing inserted into the chest wall; and also because of the danger of a pneumothorax resulting from the improper healing of the wound over the pack due to the pressure of the pack.

The experiments which we have done to establish pleural adhesions are as follows:

It was hoped that it might be possible to produce pleural adhesions by injecting into the thoracic cavity some substance which would cause sufficient irritation to bring about proliferative reaction of the pleura and the formation of adhesions. In dogs, tincture of iodine was injected into the thoracic cavity. The injection was made by means of a blunt 16-gauge needle. The needle was forced through a shaved and surgically prepared area on the chest wall into the pleural cavity. The needle was forced in slowly, overcoming the resistance of the various layers, and when finally the pleural space was entered the release of pressure against the point of the needle proclaimed this fact. In order to make absolutely certain that the pleural cavity was entered the stilette was withdrawn and an inspiratory phase watched. At inspiration we could hear the noise produced by the air as it was being sucked into the needle. A

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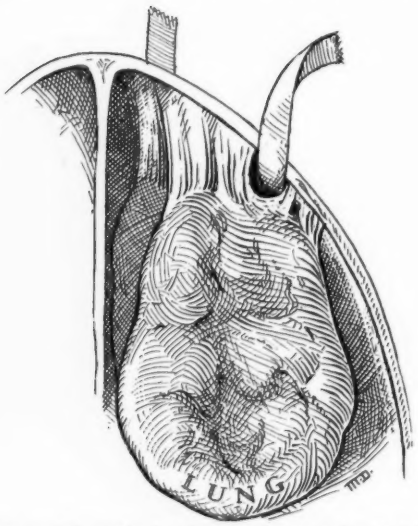

Fig. 1. Schematic drawing showing tape inserted into pleural cavity.

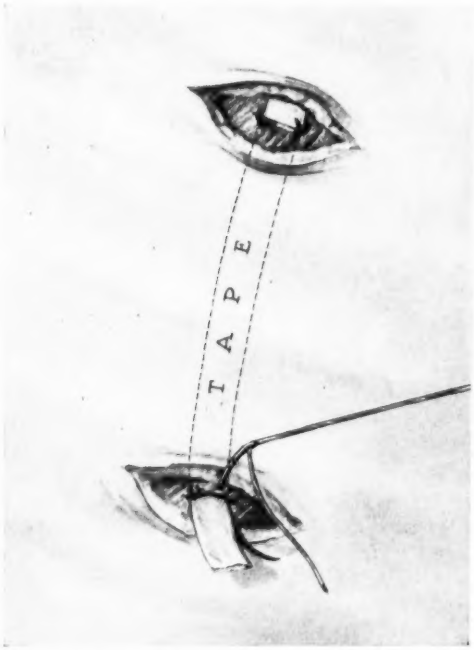

Fig. 2. Drawing showing fixation of tape to intercostal muscles.

Luer syringe was then attached to the needle and the amount of iodine desired was permitted to be aspirated into the thoracic cavity. The needle was then withdrawn and the small puncture wound sealed with collodion. In six dogs, 2 cubic centimeters was injected into the chest cavity. A week later the pleural cavities were found to be free of any pleural exudate. No adhesions were present and the site of injection either could not be found at all or was marked by a very slight scarring of the pleura. When large amounts were used a severe pleurisy was set up. Many irregular adhesions, string-like in nature, formed, and in several dogs killed 3 days after injection, an effusion was present. Ether, alcohol, and formaldehyde were injected with practically the same results except that the amount of pleural thickening produced by the formalin was markedly greater than that produced by either of the other agencies. In short, no fluid which we injected in the pleural cavity produced pleural adhesions consistently.

In a series of dogs the parietal pleura was exposed by means of an intercostal incision or by rib resection. A pack of gauze was then inserted against the pleura and the muscles and skin sutured over this. Seven days later at autopsy it was found that the pleural cavity was clear, contained no fluid, and no adhesions were present. A slight pleuritis was present, that is, the pleura was thicker and whiter than normal pleura with a few dilated blood vessels present. This experiment was then varied, so that not only a plain gauze pack was used but an iodoform gauze pack or iodinized gauze pack; the results were the same in every case. In dog 2 of this series in which the gauze pack soaked in tincture of iodine was compressed against the unopened pleura, the pack had worked its way into the pleural space, and in this case firm adhesions were present. This same result was found in another dog in which on one side the pleural pack had forced its way into the pleural cavity and adhesions resulted. I was unable to obtain a pleural effusion in any case by packing against the unopened upon pleura, except in one case in which a secondary infection ensued. In short, in dogs, packing against the unopened parietal pleura cannot be depended

Fig. 3 (left). Photograph of specimen showing pleural adhesions.
Fig. 4. Photograph of specimen showing an eight-pound weight suspended on adhesions.

upon for the formation of pleural adhesions. In my series, in no case did an external pack produce adhesions or effusion. In two instances the pack worked its way into the pleural cavity and in these cases adhesions were found.

In a series of dogs the pleura was scarified by introducing a curette through an intercostal incision and then curetting either the visceral or parietal pleura or both. In a large series of cases it was found that about one-half the animals developed fine, string-like adhesions, while in the others no adhesions were present. All these animals were operated upon under the usual drop method open ether anæsthesia, and no attempt was made to prevent a pneumothorax. In two dogs scarification of the pleura, in one the visceral, and in one the visceral and parietal, was carried out with an intertracheal pressure anæsthesia. Great pains were taken at the end of the operation to inflate the lungs so that no pneumothorax would be present. The muscle and skin were very carefully sutured and the wound sealed, as in all the experiments, with collodion. In neither of these cases did adhesions develop. I had thought that perhaps adhesions had not developed in operations done without intratracheal anæsthesia, because of the resultant pneumothorax, and for this reason was interested in finding that, even though I took the greatest of pains to avoid a pneumothorax, scarification of the pleura did not regularly cause adhesions.

In a series of dogs a large gauze pack was inserted into the pleural space. In every one of these dogs when the chest cavity was reopened, 7 days after the operation, dense adhesions were found enveloping the gauze. Except in a case secondarily infected because of opening of the wound, no, or only a very slight, pleural effusion was present.

It then occurred to me that perhaps it might be possible to simplify this method and still produce the firm adhesions which result from a foreign body placed inside the chest

wall. I took some one-half inch tape, as sold over the counter of a dry goods store, and carefully sterilized this with the instruments. I made a small intercostal incision through an upper and lower intercostal space. By means of a probe I threaded the tape from the upper to the lower intercostal space, sutured it carefully into the intercostal muscles, and buried it under the skin. The wounds were sealed with collodion. Open drop method ether anæsthesia was used. One week later the dog was sacrificed and it was found that firm pleural adhesions enveloped the tape.

I repeated this experiment again and again and found in every case that the insertion of this thin bit of tape produced firm adhesions. At no time did a pleural effusion occur except in one case which had become badly infected because the dog had chewed open one of the thoracotomy wounds. These adhesions in some instances held the tape itself fairly well fixed. In other cases, however, the tape seemed to lie in a groove of adhesions and could be removed without affecting the adhesions at all. Elastic bands and silver wire introduced similarly also produced adhesions, but the adhesions were not as firm or as strong as the adhesions produced by the tape. The tape could be introduced without the formation of a pneumothorax by making an oblique incision through the intercostal muscles and then using them to cover the opening into the pleural cavity. The tape was then pushed along the pleural space and a counter incision, also oblique, was made at the tip of the probe in the lower part of the chest. It was surprising to me to see how firmly the lung was held against the chest wall by the negative pressure and, therefore, how comparatively difficult it was to insert the tape when an attempt was made to do this without the production of a pneumothorax. As adhesions obtained by this method were no better than when a pneumothorax was produced there seemed to be no advantage in this more difficult technique. It is a well known fact that the dog will not permit of a large open pneumothorax but the openings requisite to insert the tape are so small that in no single instance was there an operative death. In several instances a large pneumothorax was purposely induced and the adhesions a week later were found to be just as firm as before. The pneumothorax had been entirely absorbed. An attempt was made to find how quickly the pleural adhesions formed, and for this reason dogs were killed at varying intervals of from one day to a week. Adhesions which had formed in a dog 24 hours after operation were very friable and would not withstand much pressure. The adhesions became firmer, until after a week the adhesions were of sufficient strength to support all the thoracic viscera when the chest was opened at autopsy. In one instance in which the dog was killed 14 days after operation the adhesions were strong enough to support a weight of 2,700 grams. While in another case in which the dog was killed 19 days after operation 6 pounds were suspended from adhesions before they tore.

CONCLUSIONS

In short, a method has been described which, in dogs at least, produces adhesions with such consistency as to be satisfactory. This method consists of inserting a bit of tape into the pleural space and allowing it to remain there for a period of at least 7 days. This operation is extremely simple of execution and can be accomplished with the production of such a slight amount of pneumothorax that no differential pressure is required. The method has several advantages over the insertion of a large pleural pack. In the first place there is no large foreign body lying just under the wound which is apt to cause a reopening of the wound; in the second place, the amount of foreign material which is buried is very slight and, therefore, the danger of infection and I think effusion is materially reduced. Lastly, in a large percentage of cases it is possible after a period of a week to remove the foreign body without interfering with the adhesions.

TYPICAL EXPERIMENTS

I. Ether anæsthesia was used. A No. 16 gauge blunt needle was inserted through a small, shaved, and prepared skin area and pushed through an intercostal space into the pleural cavity. An inspiratory phase of respiration was observed and we heard the sound of the air being sucked into the cavity. A Luer syringe was then attached to the needle and 2

cubic centimeters of iodine were aspirated into the cavity by successive inspirations. At autopsy 8 days later the pleura was clear. No effusion was found and no adhesions were present.

II. November 12, 1925, a dog was anæsthetized with ether by the open drop method. The pleura was exposed by means of intercostal incision on the right side. The pleura was not opened but was identified by the fact that through its transparent surface the underlying lung could be seen moving with each respiration. A gauze pack was placed against the pleura. The intercostal muscle was sutured over the pack; the skin was sutured with silk and covered with collodion. The left pleura was exposed; no pack was inserted. The muscle was sutured with catgut, and the skin was sutured with silk and covered with collodion. December 1, 1925, the dog was chloroformed. No infection was found at the site of the wound and the pleural cavity was opened. No pneumothorax, no pleural effusion, and no adhesions were found. There was a slight parietal pleuritis, that is, the pleura was thicker and whiter than normal and a few dilated blood vessels were seen. Paraffin section of right pleura showed pleural proliferations.

III. December 8, 1925. Ether anæsthesia was administered by open drop method. An intercostal incision exposed the parietal pleura. Under the exposed pleura, the lung could be seen moving with each inspiration. With a fine curved needle the lung was transfixed and sutured. On the left side an intercostal incision was made extending into the pleural cavity, and the visceral pleura was severely traumatized with a curved, sharp periosteotome. Thus the parietal pleura was actually curetted from the second rib down to the incision. The dog was killed with chloroform December 15. At postmortem examination we found on the right side no adhesions; the stitch hanging loose in the pleural space; no pleuritis; no pleurisy with effusion. On the left side were no adhesions, no pleural effusion; the parietal pleura showed markings of trauma, that is, beginning scar effect; no pneumothorax.

IV. December 15, 1925. A right intercostal incision was made. Ether anæsthesia by the open drop method was used. Intercostal incision. Gauze pad was inserted into the chest cavity covering the area from the second to the fifth intercostal space. The dog was killed in gas chamber, December 22, and we found the pad in place and some fresh blood in the pleura cavity; numerous fine adhesions which clung to the pad and which held the pleura together above and below the pad. The adhesions were not very strong and were easily torn.

VIII. January 7, 1926. Ether anæsthesia was used. Through a small stab wound in the upper and lower parts of the chest, right and left, a tape was threaded by means of a curved probe. The tape was sewed in place above and below with catgut sutures into the intercostal muscles. The tape was cut off just above the point of fixation. The skin was closed over this with silk and the wound sealed with collodion. January 26, the dog was killed with chloroform. Pleural adhesions were found on both sides. These adhesions enveloped the tape but the tape could be easily pulled out and the adhesions still preserved. A photograph was taken in which a weight, well over 6 pounds, was suspended from the adhesions before they tore.

FEMORAL OSTEOCHONDRITIS OF ADOLESCENTS AND SEQUELÆ

EPIPHYSEAL SEPARATION OF THE H P[1]

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THE ideas originally held by the author in regard to femoral osteochondritis of adolescents have not been changed, nor has he been otherwise impressed by the literature that has appeared since November, 1924. The literature to date has dealt with instances of moderate to marked degrees of separation of the femoral capital epiphysis. The following contains, in addition to the preceding, several extremely early cases; in fact, one might term them pre-separation instances.

The extensive literature is difficult to follow, as the titles are varied; some authorities write of epiphyseal fracture; others, of incomplete epiphyseal separation, epiphyseal coxa vara, traumatic coxa vara, adolescent rickets, pathological fracture, etc. Thus we are led to believe that the etiological factor is doubtful. The various theories proposed deal with disease, localized osteomalacia, adolescent rickets, endocrine dyscrasia, and lastly traumatism. Those adhering to the traumatic theory are Royal Whitman, Wilson, and Davis; associated with the glandular idea are the names of Hollopeau, Laurent, Kirmisson, Evans, Broca, and Vulliet; Froelich appears to be alone in support of infection as an etiological factor.

For purposes of discussion the subject matter will be dealt with in the following sequence:

1. The capital epiphysis of the femur.
2. Typical clinical and roentgen-ray findings.
3. Case reports: (a) pre-displacement stage; (b) cases of very early epiphyseal separation; (c) untreated cases; (d) more advanced instances of epiphyseal separation treated by the manipulative method of Whitman; (e) one instance of non-union; (f) cases treated by the open method; (g) roentgen-ray study of other bony regions in several of the above cases.
4. Clinical résumé.
5. Roentgenographic résumé.
6. Discussion of the various theories.
7. Uniform nomenclature suggested both by the literature and the author's findings.
8. Conclusions.

THE CAPITAL EPIPHYSIS OF THE FEMUR

Anatomists agree that the epiphysis for the head of the femur appears during the latter half of the first year of life. I. Cohen takes exception to the view prevalent among authorities that ossification occurs between the ages of 18 and 20 years and gives proof that the head and neck normally unite between the ages of 15 and 16 years.

TYPICAL CLINICAL AND ROENTGEN-RAY FINDINGS

They may be of the so-called status lymphaticus type; are found to be between the ages of 10 and 17 years, and are rarely totally disabled. Questioning elicits the following: that for 1 to 2 years prior to examination they have suffered occasional pain and stiffness at the hip or knee, accompanied by an intermittent limp. The latter usually follows some mild traumatism. The tramatism may have been of a twisting nature, a misstep, a stubbing of the toes, or a fall to the ground.

The symptoms may continue for months, and then be either spontaneously arrested, or may progress to a stage of disability, the latter most often being due to a mild injury. The last injury is usually stressed and stated to be the sole cause for the condition, especially when there is a possibility of instituting legal proceedings.

The patient is observed to walk with a hip limp, with the extremity externally rotated and slightly adducted or abducted. There is restriction of motion in flexion, abduction, and internal rotation; extension being free in the majority of cases. Here we have a diagnostic sign peculiar to this condition; for in no other intra-articular lesion of the hip do we find

[1] This treatise embodies a paper entitled "End-Result Study of Epiphyseal Separations of the Hip" which was prepared for the annual meeting of the Alumni Association of the Hospital for the Ruptured and Crippled (Nov. ,1924), and read later before the Orthopedic Section of the Academy of Medicine (Jan. ,1925).

freedom in extension. Palpation reveals a fulness in Scarpa's triangle due to the anterior twist of the neck of the femur. Mensuration discloses shortening varying from one-fourth to one-half inch.

Roentgen-ray findings. During the early stages of the condition, the epiphyseal region is observed to be widened, hazy, and occasionally fragmented. The immediate diaphyseal region may present a moth-eaten appearance or reveal irregular areas of cavitation simulating the roentgenographic appearances of bone abscesses. When displacement occurs, the diagnosis is confirmed by observing the following: "Under normal conditions the head rises sharply above the upper border of the neck; in these cases the elevation is lessened and the outline of the head and neck may form an unbroken line" (R. Whitman). This may go on to complete separation of the head, the neck appearing shorter and broader due to outward rotation of the shaft, and the epiphysis flattened as a result of backward rotation. In the healed cases the changes noted are: premature ossification of the epiphyseal line; increased deposition of lime salts, obliterating the eroded areas; occasional diminution of the joint space due to absorption of cartilage of the femoral head and in some instances from the acetabulum; irregularity of the epiphysis; varying degrees of coxa vara due to faulty reposition of the fragments; occasional flatten[i]ng and mushrooming of the femoral epiphysis simulating a healed instance of Perthes' disease; and lastly, changes indicative of osteoarthritis. Non-union has been observed in one of the recorded cases.

CASE REPORTS

Group A. Pre-displacement Stage

CASE 1. R. D., age 10 years, female, schoolgirl, was observed at the Clinic of the Hospital for the Ruptured and Crippled August 17, 1925. Patient stated that she sustained an injury to the left hip 3 weeks before, and since then has been walking about with a limp, but suffering no pain. She injured her hip as a result of a fall while roller skating. Further questioning elicited the statement that she has suffered occasional pain about the left hip for 1 year. This, however, has not been severe enough to warrant medical attention.

Examination reveals a normally developed child (height, 61 inches, weight, 89 pounds) walking about without assistance, but with a mild left hip limp. The right anterior superior spine of the ilium is maintained higher than that of the opposite side. Movements of the left hip are partially restricted; flexion being possible to 100 degrees; extension to 170 degrees; and abduction to 10 degrees. Rotation was not disturbed. Psoas spasm was not present. Mensuration disclosed no shortening of the lower extremities.

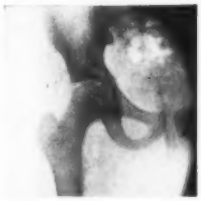

Fig. 1. Case 1, R. D. Diaphyseal erosion and widening of the epiphyseal line.

Roentgen-ray examination on the right hip is negative for bone and joint pathology. The left hip presents a widening of the epiphyseal line, more especially in its inferior half; absorption of the metaphysis for a distance of one-fourth inch; no evidence of displacement of the epiphysis; irregularity, and increase in density of the outer third of the rim of the acetabulum.

A left hip spica plaster bandage was applied and maintained in position until October 27, 1925. Re-examination now shows the hip to be freely movable in all directions.

Roentgenogram on October 27, 1925, shows the presence of a barely perceptible displacement of the capital epiphysis. The erosion has extended one-fourth of an inch distally. The eroded area, however, has increased in density.

Plaster spica bandage reapplied October 27, 1925. On removal of the bandage January 2, 1926, a new roentgenogram was ordered. This showed no further changes. When last observed February 19, 1926, the patient had been getting about without support and suffered no ill effects. Movements of the hip were free and painless. The roentgenogram resembles that of October, 1925, except that the eroded area is of greater density than the surrounding bone. This signifies healing.

CASE 2. P. R., age 12 years, female, schoolgirl, presented herself at the clinic December 8, 1925, because of pain and limp of the left hip region. Patient states that she has been perfectly well until 3 weeks before, when without cause she suffered pain of the left hip. She commenced limping a few days thereafter. Patient denies any recent or remote history of an injury or infection. Examination shows a well developed girl (weight, 90 pounds, height, 4 feet 11 inches), walking about with a left hip limp. Movements of the hip are restricted in abduction and internal rotation; all other motions are free. Extension is somewhat freer than that of the other

Fig. 2.

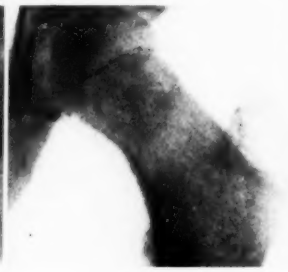

Fig. 3.

Fig. 4.

Fig. 2. Case 3, H. G. Widening of the epiphyseal line and downward displacement of the epiphysis.

Fig. 3. Case 3. Normal hip.

Fig. 4. Case 3. Photograph of patient at the time of initial observation. Clinically presents no evidence of deformity.

side. There is tenderness over the head of the left femur. Mensuration is equal both for circumference and length. Roentgenologically the right hip region is negative. The left hip shows a widening of the epiphyseal line, decalcification of immediate diaphyseal region for three-eighths of an inch, and shortening of the neck of the femur. A short plaster-of-Paris hip spica was applied in the walking attitude, and the patient advised to rest as much as was possible. The above was removed January 25, 1926, and the hip rayed. The roentgenogram resembles that of a normal hip except for some slight widening of the epiphyseal line.

Group B. Cases Demonstrating Mild Epiphyseal Displacements

CASE 3. H. G., age 15 years, male, schoolboy, was first observed April 1, 1924, stating that he was perfectly well until 9 months ago, when, without cause, he suffered pain along the anterior surface of the left thigh. No history of infection, nor of injury. From time to time he limped. This would last for a few days and then disappear spontaneously.

Examination reveals an overgrown boy, walking about unaided without a perceptible limp. Movements of the hip are free and painless. The left lower extremity measures three-sixteenths of an inch less than its fellow. There is no atrophy present.

Roentgenogram brought by patient discloses a normal right hip region. The left hip shows the epiphysis flattened; the epiphyseal line widened; irregular decalcification of the juxta-epiphyseal region presenting the appearance of fragmentation; widening and shortening of the femoral neck and a mild upward displacement of the shaft of the femur. The outline of the head and neck form an unbroken line.

Patient refused treatment in the form of the application of a hip spica with freedom from weight bearing. The Social Service Department of the Hospital for the Ruptured and Crippled reported November, 1924 (16 months after onset of condition), that the patient has received no treatment since coming to the clinic, and that the hip remains unchanged.

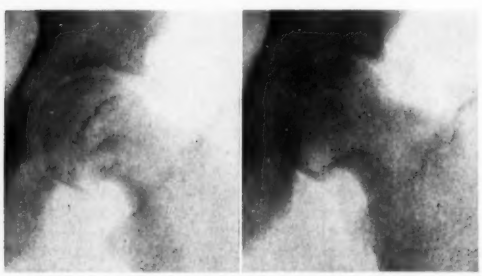

Fig. 5 (left). Case 4, F. S. Roentgenogram of affected hip showing, in addition to the widening of the epiphyseal line and softening of the juxta-epiphyseal region, an area of cavitation highly suggestive of that resulting from the presence of an infection.

Fig. 6. Case 4, F. S. Roentgenogram of the same hip as in Figure 5, taken 13 months later.

CASE 4. F. S., age 13 years, female, schoolgirl, was admitted to the Clinic of the Hospital for the Ruptured and Crippled, July 27, 1923, stating that she was perfectly well until 2 months ago, when she received a slight injury to the left hip. The patient was standing in a crowded train, when the train stopped suddenly, causing the patient to lurch suddenly forward. Since then she has walked about with a left hip limp, and complained of slight pain.

Examination reveals a slightly overgrown girl walking about with a slight left hip limp, with the limb in external rotation. Both internal rotation and abduction were partially restricted. Mensuration revealed one-eighth inch of shortening and no atrophy.

Roentgen-ray examination shows the right hip region normal in all respects. The left hip shows a flattened femoral head, slightly displaced epiphysis; widening of the epiphyseal line with absorption of

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

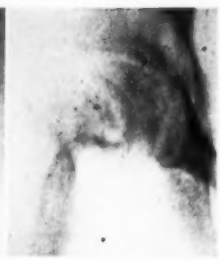

Fig. 11.

Fig. 7. Case 7, M. G. Photograph at the time of admission to the hospital.

Fig. 8. Case 7, M. G. Roentgenogram showing the presence of a bilateral epiphyseal separation.

Fig. 9. Case 7, M. G. Roentgenogram of left hip 2 years after reduction. Functionally a poor result.

Fig. 10. Case 8, A. H. Roentgenogram of left hip (June, 1921) showing a widening of the epiphyseal line, juxta-epiphyseal softening, and a barely perceptible displacement of the epiphysis.

Fig. 11. Case 8, A. H. Roentgenogram of the same hip taken November, 1921.

lime salts for a zone of three-eighths of an inch; an area of cavitation of the inferior pole of the juxta-epiphyseal region surrounded by an area of increased density (resembles a bone abscess). The patient received no treatment, and when last seen, August, 1924, she was perfectly well. Motions were free and painless. The affected extremity was one-eighth of an inch shorter than its fellow. Roentgenogram of August, 1924, showed the presence of premature ossification of the left epiphyseal line; uniform density of both the head and the femoral neck. The epiphyseal line on the opposite side was still in evidence.

CASE 5. V. R., age 13 years, male, schoolboy, was observed at the Cornell Clinic July 25, 1921, because of pain and partial disability of the left lower extremity. The patient gave a history of an injury while playing basketball some 9 months before.

Examination shows an overgrown boy, walking about with a left hip limp. Motions are restricted in all directions, except extension. The left lower extremity is one-half inch shorter, and the left thigh is one-half inch less in circumference than that of the right. The roentgenogram presented a flattening of the head of the femur and a slight displacement of the epiphysis. The hip was immobilized in a plaster-of-Paris spica bandage. This was renewed from time to time. When last observed, October, 1924, the patient had completely recovered.

Group C. Untreated Cases

CASE 6. I. L., age 14 years, male, schoolboy, was admitted to the Hospital for the Ruptured and Crippled November, 1921, complaining of pain and limp of the right hip region, duration 7 months. April 1, 1920, while wrestling with another boy he was injured. He suffered no ill effects for 1 week. Pain and limp occurred simultaneously. Discomfort increased with motion and disappeared with rest. One month later the pain subsided sufficiently to permit of his attending school.

Examination at the time of admission revealed an overgrown boy walking about with a marked limp on the right side, with the limb rotated externally. The extremity was one-fourth inch shorter than its fellow, and the thigh measured three-fourths inch less in circumference. Flexion was restricted to 90 degrees, inward rotation and abduction were completely restricted. The roentgen-ray shows a typical epiphyseal separation of but slight degree with almost complete healing at the site of displacement. The hip was manipulated under an anæsthetic to increase the range of motion.

On re-examination August, 1924, patient complains of pain after walking short distances. Walks with a slight right hip limp. All motions are free, except abduction which is restricted one-half normal; internal rotation possible to one-third normal. The right lower extremity is three-fourths inch shorter

Fig. 12 (left). Case 8, A. H. Roentgenogram of March, 1922, several months following reduction of the separation.

Fig. 13. Case 8, A. H. Roentgenogram of both hips taken August, 1924. The right hip region is normal. The left hip shows complete ossification of the epiphyseal line, large mushroomed femoral head, short and broad neck.

than its fellow; the thigh presents an atrophy of 2 inches, and the calf 0.5 inch.

Group D. More Advanced Instances of Epiphyseal Separation Treated by Manipulation

CASE 7. M. G., age 15 years, male, schoolboy, was admitted to the Cornell Clinic November, 1922, complaining of pain, limp, and inability to separate the knees. April, 1921, the patient while playing jumped over a rock (height, about 6 inches) and landed on the right foot. This was immediately followed by pain and disability. He was removed to a hospital where a plaster hip spica bandage was applied, and maintained in position for 9 weeks. Following the removal of the plaster he was fitted with a hip brace, and told that he suffered a pathological fracture of a tuberculous joint. In June, 1922, without cause, he suffered pain of the left hip region. He received no treatment until the time of admission to the clinic.

Examination showed an obese young male walking about with the aid of two canes; the thighs are markedly adducted with the right knee held in front of the left. He presents a bilateral knock-knee deformity with the patellæ rotated outward. Both hip joints are maintained in an attitude of partial flexion. Motions are restricted in all directions. The patient was admitted to the Hospital for the Ruptured and Crippled where, after several forcible stretchings and an osteotomy of the right femur, the deformities were corrected.

Re-examination was made in November, 1924. Patient can walk for short distances without assistance. The deformities remain corrected. The right hip allows of some passive motion. The left hip is practically fixed.

Roentgen-ray examination was made July, 1923. The right hip presents a coxa vara deformity with complete ossification of the epiphyseal line; a short and broad femoral neck; diminution of the interarticular joint space; irregularity of the head. The left hip at the time of admission to the hospital showed the presence of a recent epiphyseal separation. The same region now discloses: incomplete ossification of the epiphyseal line; irregularity of the head; diminution of the joint space; and capsular thickening. Roentgenograms made November, 1924, reveal very little difference, except for complete ossification of the left epiphyseal line.

CASE 8. A. H., age 13 years, male, schoolboy, admitted to the clinic November 22, 1921, complaining of a pain in left hip of 5 months' duration. The onset was gradual and was not accompanied by an injury. The patient was treated for Perthes' disease of the hip by the application of short plaster-of-Paris spica bandages. As the hip became worse and examination disclosed an epiphyseal separation, the patient's hip was manipulated under an anæsthetic, and a long plaster spica applied.

On re-examination in August, 1924, we find that the patient walks with a slight hip limp, and complains of pain after walking comparatively short distances. Abduction and internal rotation are moderately restricted. The affected limb is three-fourths inch shorter. The thigh presents an atrophy of 1 inch.

Roentgen-ray examination June, 1921, shows the right hip normal for bone pathology. The left hip shows flattening of the epiphysis; widening of the epiphyseal line; very slight epiphyseal displacement; loss of lime salts of the juxta-epiphyseal region. September, 1921, roentgenogram shows the above and in addition a mottling of one-half of the femoral neck. In November, 1921, we found absorption of part of the femoral neck with further displacement of the head on the neck. In March, 1922, we found partial ossification of the epiphyseal line and deposition of lime salts in the neck of the femur. Incomplete reduction of the fragments is shown. In August, 1924, we found a well formed head with flattening of the upper pole resembling the late stage in certain cases of Perthes' disease of the hip, short and broad neck, complete ossification of the epiphyseal line.

The opposite hip is normal and shows the presence of ossification of its epiphyseal line.

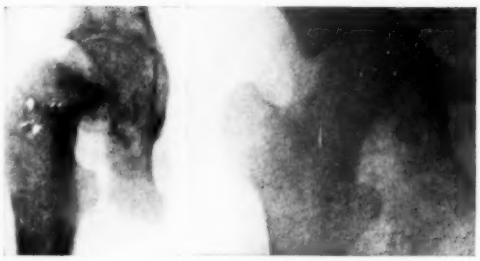

Fig. 14.

Fig. 15.

Fig. 14. Case 9, V. C. Right hip showing moderate degree of epiphyseal separation (June 8, 1923).

Fig. 15. Case 9, V. C. Same hip as shown in previous figure. Roentgenogram of August, 1924, shows a satisfactory reduction of the fragments; diminution of the joint space; irregularity of the femoral head; and premature ossification of the epiphyseal line.

Fig. 16.

Fig. 17.

Fig. 16. Case 16, T. G. Instance of non-union at the site of separation.

Fig. 17. Case 18, A. Z. Roentgenogram of November, 1924, which was made some 16 years following an open operation for epiphyseal separation of the hip. Roentgenologically the hip resembles the late stage, in certain instances, of Perthes' disease.

CASE 9. V. C., age 13 years, female, schoolgirl, was admitted to the hospital in June, 1923, complaining of pain and partial disability of the right lower extremity of 9 weeks' duration. At the time of onset, she was struck across the knee from behind, and was caused to fall to the ground. She was assisted home and placed in bed, where she remained for 3 weeks. Soon after admission to the hospital the affected hip was manipulated under an anæsthetic and a long plaster spica bandage applied. At the end of 10 weeks the plaster was changed, the hip being maintained in an attitude of lessened abduction. Patient was discharged at the end of 5 months, walking with the aid of crutches. Since discharge, she has been receiving physical therapy.

Examination in August, 1924, and in October, 1925, shows that the patient is able to walk about without assistance, but with a definite right hip limp. She complains of no pain. The hip is practically fixed in a good walking attitude. The affected extremity is 1 inch shorter, the thigh presents an atrophy of 2 inches, and the calf of 1 inch.

The roentgenograms of June, 1923, show the left hip normal. In the right hip region we found outward rotation and upward displacement of the shaft of the femur; erosion of the proximal half of the neck; marked separation of the epiphysis. In December, 1923, the roentgenogram shows the presence of a premature ossification of the epiphyseal line; good reduction of the fragments; diminution of the joint space. That of August, 1923, is similar in all respects to the previous picture, and in addition shows some irregularity of the head of the femur, plus an outward rotation deformity of the shaft.

CASE 10. M. A., age 12 years, female, schoolgirl, obese and tall for age, admitted to the hospital April, 1923, with the following history. For 2 years prior to admission she suffered occasional pain of the left hip region, accompanied by an intermittent limp. About 1 year later she sustained a rather mild injury causing her pain and to limp for 2 weeks. Two weeks before admission to the hospital she caught her left foot in a car track, and suffered a twisting injury. This caused her to fall to the street. She had to be assisted home. At the time of her appearance at the hospital she walked awkwardly without assistance, but with great difficulty. The left thigh was adducted and externally rotated. There was a noticeable atrophy of both thigh and calf. All motions of the hip were restricted and painful. Soon after entry into the hospital, the affected hip was manipulated under an anæsthetic and a long plaster spica bandage applied. Ten weeks later the plaster was removed and a new one applied with the limb in a walking attitude. Following the removal of the last plaster the patient received physical therapy. She is still under treatment.

Re-examination was made in December, 1925. Patient walks about with a noticeable hip limp. Movements of the hip are partially restricted, more especially internal rotation and abduction. Flexion is possible to 90 degrees. The affected limb is three-fourths inch shorter; the thigh measures 2 inches less and the calf one-half inch less than that of the opposite side.

Roentgen-ray study. A film made in April, 1923, showed an upward and outward displacement of the shaft of the femur; the head appeared flat. Roentgenogram taken 6 months later showed a satisfactory reduction with premature ossification of the epiphyseal line; diminution of the joint space; erosion of the upper pole of the femoral head. The films of May, 1924, revealed similar findings to the previous but more exaggerated. Roentgen-ray of January, 1925, and of August, 1925, showed in addition to the above an irregularity of the acetabulum.

CASE 11. R. T., age 11 years, female, schoolgirl, was admitted to the Hospital for the Ruptured and Crippled in June, 1922, complaining of difficulty in walking. Two months ago the child fell from a swing, landing on the right hip. This was followed by pain in both the hip and knee regions, accompanied by a limp. Movements are but slightly

Fig. 18. Case 10, M. A. An instance of vertebral epiphysitis associated with epiphyseal separation of the hip. The roentgenogram demonstrates irregularity of the superior and inferior borders of the middorsal vertebræ.

restricted, abduction being limited to two-thirds. The roentgenogram shows the presence of a bilateral epiphyseal separation for which an anæsthetic was administered, and reduction attempted. A bilateral hip spica bandage was applied. Treatment was discontinued in January, 1923, because of good recovery. The child was apparently well until July, 1923, when she again fell and injured the left hip. Examination now disclosed a new separation of the left hip. This new condition was reduced under an anæsthetic and a long plaster spica bandage applied.

In response to a follow-up letter in August, 1924, the mother reported that the child is still wearing a plaster spica bandage on the left side. She also states that the right hip is not quite well as yet.

Case 12. W. K., age 16, an overgrown boy, was first seen by the author July 14, 1917, at the Mary Immaculate Hospital, Jamaica, Long Island, where he was removed in an ambulance because of pain and total disability of the left lower extremity. An hour prior to admission to the hospital he was in swimming, and while making a sudden turn in the water following a dive, he suffered a sudden severe pain in the left hip accompanied by the sensation of a snap. In the preceding year he had suffered an occasional pain and limp of the same hip. For the preceding 7 weeks these symptoms were more pronounced. Two unsuccessful attempts were made at reduction. The long plaster spica was then converted into a short one and the patient referred to the Hospital for the Ruptured and Crippled. The separation was finally reduced at the latter institution. Recent observation in March, 1925, showed the hip to be freely movable in all directions and also painless.

Case 13. M. M., age 13½ years, female, was admitted to the Hospital for the Ruptured and Crippled November 2, 1925, because of inability to walk for the past 3 days. Patient states that she was perfectly well until 3 weeks before when she fell while at home and injured the right side. She began limping immediately. Patient is excessively tall for her age, and underweight for her height. The right lower extremity is maintained in extreme external rotation, and the patient is unable to raise the extended limb from off the examining table. The affected extremity measures one-half inch shorter than its fellow. Roentgenogram of the right hip shows the presence of a coxa valgus deformity with the epiphyseal line placed horizontally. The left hip presents a similar condition, and in addition an upward displacement of the shaft of the femur. The femoral head appears flat; the juxta-epiphyseal region appears mottled.

Case 14. R. L., age 11 years, female, was admitted to the hospital December 8, 1925, because of a marked external rotation of the right lower extremity. Two years before the patient fell while roller skating, injuring both hips. She recovered completely within a few days. One year ago she commenced limping on the right side, and had occasional pains. The pain subsided 6 months ago, but since that time she has been falling often because of the extreme outward rotation of the limb.

Examination showed patient to be of normal height and weight for her age. She walks awkwardly with a right hip limp, with the limb maintained in marked external rotation. Flexion is possible to a right angle only when the extremity is externally rotated; otherwise it is much less. All other motions are somewhat restricted. There is approximately one-half inch of shortening.

Roentgen-ray examination shows the left hip normal in all respects. The right hip presents a mottling of the entire femoral neck. The neck is short and broad. The epiphyseal line is irregular. The shaft is displaced upward, and the head appears flattened. The outer half of the acetabular rim is irregular.

Case 15. R. L., age 12 years, female, admitted to the hospital October 10, 1922, complaining of pain in the left knee accompanied by a limp; duration, 4 weeks. Examination disclosed findings typical of an epiphyseal separation. The abduction treatment was carried out, and the patient gradually recovered. In March, 1924, the hip was manipulated and a short plaster spica bandage applied because of some restriction of motion. The plaster was removed within a short time; and on June 28, 1924, the patient again returned to the hospital complaining of pain and stiffness on the left side. This resulted from a fall from a bicycle 1 month before. Examination at this time showed that flexion was possible to 140 degrees. The limb was held in external rotation and in slight abduction. Motions were restricted and painful.

The roentgenogram of October, 1922, showed a slight widening of the epiphyseal line, and some downward displacement of the epiphysis. That of June, 1924, showed a destruction of part of the head; obliteration of the epiphyseal line; short and broad neck; diminution of the joint space; small fragment of bone separated from the upper pole of the head simulating the picture observed in osteochondritis of the knee.

Group E. An Instance of Non-union

CASE 16. T. G., age 17 years, male, was admitted to the hospital in September, 1922, complaining of pain in the left hip region of 1 month's duration. Patient states that about one year before he sustained an injury to the hip in a football game. However, there was no immediate disability. Some 6 months later he began walking with a limp; this, however, did not last long.

Examination showed a tall, overgrown male walking about with a marked limp of the left lower extremity, the thigh being externally rotated and adducted. Flexion, abduction and internal rotation of the hip are restricted. The affected extremity is shorter by three-fourths of an inch. Two forcible manipulations were required to reduce the separation. Re-examination in August, 1924, showed no improvement over the original condition. Patient became tired readily, could not dress himself completely, and was unable to work.

The roentgenograms of September, 1922, showed the presence of a coxa vara deformity with widening of the epiphyseal region and displacement of the shaft of the femur upward. The unaffected hip showed practically complete ossification of the epiphyseal line. Roentgenogram February, 1923, revealed a partial correction of the deformity; narrowing of the joint space; shortening of the neck; and softening of the diaphyseal segment. The roentgenograph of August, 1924, showed the presence of a recurrence of the deformity, and in addition to the above findings, an erosion of the upper pole of the acetabulum. The opposite hip remained normal in all respects.

Group F. Cases Treated by the Open Method

CASE 17. L. R., age 32 years, male, baker, returned to the clinic January 6, 1925, because of pain across the lower part of the back and about the left hip. This condition had been present for many years. Due to the increasing severity of the pain, he was unable to continue at his occupation. He was operated upon April 15, 1908, at the Hospital for the Ruptured and Crippled, a wedge of bone being removed from the femoral neck allowing for the approximation of the fragments. The separation had been present for 1 year prior to operation. Since that time he has been getting about with a slight limp and an occasional pain.

Examination was made in January, 1925. Patient walks about with a left hip limp, with the limb maintained in an attitude of flexion, adduction, and internal rotation. Flexion is possible to 110 degrees; extension to 165 degrees; both internal and external rotation are completely restricted. Mensuration reveals a shortening of three-fourths of an inch; 3 inches atrophy of the thigh; and one-half inch atrophy of the calf.

The roentgenogram of January, 1925, showed a large mushroomed irregular head filling the entire acetabulum; almost complete obliteration of the joint; a short broad neck; approximation of the greater trochanter and upper rim of the acetabulum (the two are separated by about three-eighths of an inch).

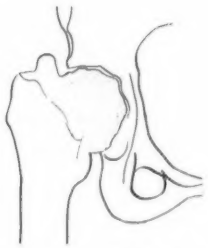

Fig. 19. Case 17, L. R. Drawing from roentgenogram showing appearance of hip 17 years following open operation for epiphyseal separation.

CASE 18. A. Z., age 31 years, male, was operated upon some 16 years ago at the Hospital for the Ruptured and Crippled for an epiphyseal separation of the left hip of 1 year's duration. He now returns because of persistent pain about the hip and knee. Patient states that he remained free from pain for a number of years following the operation.

Examination showed a well developed male of normal weight for his height, walking about without assistance, but with a left hip limp; the limb being maintained in an attitude of flexion and external rotation. Flexion of the hip is possible to a right angle; extension to 170 degrees; abduction to 10 degrees; internal rotation being completely restricted. The affected limb is shorter by 1 inch; presents an atrophy of 3 inches of the thigh and one-half inch of the calf.

The roentgenogram of November, 1924, discloses the presence of a mushroomed head; short and broad neck; coxa vara deformity; but no diminution of the interarticular space. The findings are quite similar to those observed in the late stages of certain instances of Perthes' disease.

GROUP G. ROENTGEN-RAY STUDY OF OTHER BONY REGIONS IN SEVERAL CASES

The cases studied were all recent instances of epiphyseal separation with the exception of M. A. Of the entire series five patients were subjected to a roentgen-ray examination of the spine, knees, and os calcis in addition to that of the hips. An additional recent case was added so that three definitely endocrine cases and three non-endocrine in make-up could be compared with one another. All 6 were females ranging in age from 10 to 14½ years.

Of these only two (of the endocrine type) patients, M. M. (Case 13) and M. A. (Case 10),

showed changes of the epiphyses of several of the lower dorsal vertebræ. All other epiphyseal regions examined were normal. M. M. presented a mild posterior (functional) curvature of the dorsal spine. M. A. presented clinically and radiologically an upper left dorsal curve and an accompanying lower right lumbar deviation. In addition to the above there was present a mild degree of rotation. These findings were noted about one year ago and have increased to date, even though the shortening of the involved extremity was compensated for by raising the shoe.

TABLE I.—CLINICAL RÉSUMÉ

Case		Age in years	Sex	Side	Duration	Injury	Endocrine type	Shortening Inches	End-result
1	R. D.	10	F	L	3 wks.	Yes			
2	P. R.	12	F	L	3 wks.				
3	H. G.	15	M	L	9 mos.		Yes	3/8	
4	F. S.	13	F	L	2 mos.	Yes	Yes	1/8	Excellent.
5	V. R.	13	M	L	9 mos.	Yes	Yes	1/2	Excellent.
6	I. L.	14	M	R	7 mos.	Yes	Yes	1/4	Satisfactory.
7	M. G.	15	M	R	1½ yrs.	Yes	Yes		Poor.
				L	5 mos.				Poor.
8	A. H.	13	M	L	5 mos.			3/4	Satisfactory.
9	V. C.	13	F	R	9 wks.	Yes		1	Poor.
10	M. A.	12	F	L	2 wks.	Yes	Yes	3/4	Poor.
11	R. T.	11	F	R	2 mos.	Yes			
12	W. K.	16	M	L	1 hr.	Yes	Yes		Excellent.
13	M. M.	13¼	F	R	3 wks.	Yes	Yes	1/2	
14	R. L.	11	F	R	1 yr.	Yes		1/2	
15	R. L.	12	F	L	4 wks.	Yes			Poor.
16	T. G.	17	M	L	1 yr.	Yes	Yes	3/4	Poor.
17	L. R.	15*	M	L	1 yr.	Yes		3/4	Poor.
18	A. Z.	14†	M	L	1 yr.	Yes		1	Fair.

*32 when last seen.
†31 when last seen.

1. In the 18 reported cases there were 20 instances of varying degrees of epiphyseal separation.

2. Bilateral involvement was noted in 2 cases, 11 per cent at the entire series (Table I).

3. The sexes were equally affected.

4. The age at the time of initial observation varied from 10 to 17 years, the average age being 13.3 years.

5. Nine out of 18 could be classified as overgrown.

6. Fifteen hips were subjected to mild traumata, no one instance being severe enough of itself to be able to cause a fracture if the child were normal and of the same age.

7. The duration of the condition prior to the time of institution of treatment varied from 1 hour to 1½ years, the average period being about 6 months.

8. The left hip was separated in 14 instances, and the right in 6.

9. There was an end-result shortening of from one-eighth to 1 inch; the average being about one-half inch.

10. The end-results from a functional standpoint may be summarized as follows:

In Group B we have 2 excellent results out of 3 cases. In Group C we have 1 case with satisfactory result. In Group D we have 6 cases and in one patient both hips were affected, making 7 hips in all in this group. In 5 hips the result was poor; in one the result was excellent and in the other satisfactory. In Group E we have one case of non-union. In Group F, of 2 cases one is to be classed as poor and the other as satisfactory.

In Group B, we found (1) a flattened appearance of the epiphysis due to its backward rotation, (2) widening of the epiphyseal line, (3) haziness of the epiphyseal line, (4) occasional appearance of fragmentation of the epiphyseal line region (irregular islands of bone), (5) short and broad femoral neck due to outward rotation of the shaft of the femur, (6) juxta-epiphyseal bone absorption; occasioral cavity formation, (7) downward displacement of the femoral head, or what actually takes place, an upward displacement of the shaft.

In Groups C, D, and E, we found (1) early stages resembling those previously described; (2) varying degrees of displacement of the epiphysis; (3) late changes such as (a) premature ossification of the epiphyseal line, (b) occasional diminution of joint space, (c) occasional irregularity of head, (d) occasional flattening of the head, resembling the late stage in some of the cases of Perthes' disease, (e) short and broad neck, (f) lessening of the angle between the neck and shaft of the femur due to incomplete reposition of the fragments, (g) non-union (rare), (h) occasional erosion of acetabulum, (i) capsular thickening, roentgenographically shown by an increase in the density of the capsular region.

In Group F, we have the following X-ray findings: (1) large irregular femoral head, (2) diminution of the joint space, (3) short and broad femoral neck, and (4) diminution of the normal angle between the neck and shaft.

DISCUSSION OF THE VARIOUS THEORIES

The rôle played by infection. Studies by Froelich have tended to show that the condition is infectious in origin. Klinefelter in discussing Wilson's paper cites an instance in which removal of a section of tissue at the time of operation was later reported to be of a mildly inflammatory nature.

Several instances are recorded in individuals who are not of the overgrown type, and who have not been subjected to traumatisms, yet the roentgenograms of the affected hips present findings (erosion and cavitation) that are suggestive of infection.

Disorganization of the joint with the resultant symptoms simulating those of an infectious arthritis of a large joint have been observed in several of the recorded cases. In no other joint of the body that has suffered an epiphyseal separation of one of its component parts does a similar condition ensue. This latter condition holds true whether the separation is totally or partially corrected. The statement has been made that the complicating arthritides of epiphyseal displacements follow imperfect reductions. The author has cited an instance of fibrous fixation of the hip in a case with perfect reduction of the fragments. Instances of but partial reduction are quoted in which the end-results are to be considered satisfactory.

The relationship between osteochondritis juvenilis deformans and the subject under discussion is quite striking in both the early and late stages. In both conditions we are confronted by roentgenograms showing a mottling of the diaphyseal portion of the epiphyseal line, and in addition cavity formation. Short and broad femoral necks are to be observed during the course of both diseases. Years later there often results a flattening and mushrooming of the capital epiphysis. Furthermore, several instances of Perthes' disease have been shown to be infectious in origin. The author is inclined toward the infectious theory in osteochondritis juvenilis. The author also wishes to express the view that if early cases of both Perthes' disease and adolescent osteochondritis were operated upon, the presence of an inflammatory reaction in the sectioned tissues would be observed. It would appear that both diseases arise from a common origin. Whereas Perthes' disease primarily involves the femoral head and later traverses the epiphyseal line, adolescent osteochondritis primarily affects the juxta-epiphyseal region. In this latter respect it resembles osteomyelitis of other parts of the body, as the infection travels through the blood stream and localizes in the regions supplied by the terminal end arteries of the metaphysis.

Rachitis and endocrine dysfunction. As rickets is a generalized disturbance, one would expect to find other epiphyseal localities affected. Such has not been our experience in 6 cases which were subjected to roentgenographic examination of other parts of the body. The above opinion is concurred in by Wilson, who also studied several cases of epiphyseal displacement. The same reasoning is to be applied to endocrine dyscrasia as a probable factor in the etiology of epiphyseal separation. Engelbach and McMahan, who have examined 2,000 cases of glandular disturbances roentgenologically, state that in uncomplicated hypothyroidism there is a retardation of development of all of the bones of the osseous system; cases of hypogonadism plus active secretion from the anterior portion of the hypophysis show a late fusion of the epiphyseal ends of the long bones and an accompanying overgrowth of the long bones. One would, therefore, expect to find changes similar to those previously described in other epiphyseal regions, yet complete roentgen-ray examination of 6 cases described in the previous records revealed no evidence of involvement of those epiphyses most subject to strain (those for the tibial tubercle or os calcis). In only two instances was there some slight evidence of disturbance of the epiphyseal regions of some of the dorsal vertebræ. Of the entire series but two patients showed involvement of both hips. Of the 18 cases 9 at most could be classified as overgrown.

In those cases classified as overgrown, the author could not discern any evidence of disturbance of the epiphyseal region of the unaffected hips. Patient T. G., age 17 years, overgrown male of the Froehlich syndrome type, showed no delay in the time of ossification of the unaffected hip.

Traumatism. It cannot be denied that injury may direct our attention to the process, for the patient develops symptoms for which medical treatment is sought. In other words the injury is the accentuator of a process that normally might become spontaneously arrested. Traumatism might even initiate the affection as it is apt to do in other parts of the body (osteomyelitis following injury). We are here dealing with a diseased area that permits of a disunion of the head and neck of the femur, although an injury is not essential. Experimental evidence (Poland and Rammstedt) is against the theory that the condition is due to a fracture, i.e., fracture through healthy structures. In normal adolescents it is hardly possible to create a subcapital fracture of the neck of the femur. Injuries of this type are quite rare in any period of life.

Should traumatism of the nature described be the sole cause, one would expect to find numerous instances of fracture of the epiphyseal region, whereas it is observed rather infrequently. In a recent article Wilson states that at the time of operation "the separated surfaces were not irregular, although they were slightly granular in appearance. They were grayish and not vascular. The appearance was not that of a fracture . . . ."

UNIFORM NOMENCLATURE SUGGESTED BOTH BY THE LITERATURE AND THE AUTHOR'S FINDINGS

Epiphyseal separation, coxa vara, and the arthritides are to be considered as sequelæ of femoral osteochondritis of adolescents. One might venture to suggest for the sake of uniformity that the same terminology might be used in instances in which there is involvement of the vertebral epiphyses, the epiphysis of the tibial tubercle, and the epiphysis of the os calcis. Thus we would have vertebral osteochondritis of adolescents, osteochondritis of the tibial tubercle, and osteochondritis of the os calcis.

CONCLUSIONS

In conclusion it might be stated that we are dealing with an osteochondritis involving the diaphyseal portion of the epiphyseal line and the immediate diaphysis of the neck of the femur; that the origin is probably a low grade infection; that traumatism and endocrine dysfunction are contributory causes.

That the time of onset of the actual disturbance (at about the age of 11 years) is long before the patients are observed by the orthopedic surgeon.

That those instances complicated by moderate or marked epiphyseal separation that are subjected to forcible manipulations result in varying degrees of arthritis.

That there is a distinct relationship between osteochondritis of adolescents and Perthes' disease (osteochondritis juvenilis deformans).

That this is a cause of some instances of osteo-arthritis of adult life.

That we therefore have the following sequence: first decade, Perthes' disease; second decade, femoral osteochondritis complicated by varying degrees of slipping of the capital epiphysis; third decade and later, osteo-arthritis.

The author wishes to take this opportunity to thank those who have permitted him the use of certain data.

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DRAINAGE AS A FACTOR IN RENAL DISEASE[1]

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An experience with over 2,500 patients in whom a diagnosis of ureteral stricture was made convinces me that in the past we have not grasped the importance of drainage as a factor in renal disease; and as a consequence we have too often focused our attention on the renal lesion, and have overlooked its immediate cause.

In 1902, Kelly's[1] master mind flashed forth an hypothesis covering this subject that was so far in advance of the views of his day that it was completely ignored, and even forgotten by its author. In the interim lesser minds, in the plodding routine of observing, comparing, and analyzing data on large numbers of patients have finally arrived at the advanced position heralded by Kelly nearly a quarter of a century ago.

The literature of the past 10 years has shown an increasing appreciation of the importance of the ureter as a vital organ, subject to its primary and secondary diseases, and particularly of the important bearing ureteral diseases have on disorders of the kidney.

As causes of hydronephrosis, pyelitis, and other pathological conditions found in the kidney, we have had emphasis placed on such conditions as body form, sagging kidney, aberrant vessels, ureteral kinks, various intrarenal and extrarenal and intra-ureteral and extra-ureteral lesions, tumors, inflammatory masses, pregnancy, vesical and urethral lesions, and displacements of the pelvic organs. In dealing with approximately 500 cases of hydronephrosis and a like number of pyelitis, I have had experience with most of the above factors as causative agents in impaired drainage; but the demonstration of ureteral stricture as an associated lesion in more than 90 per cent of all hydronephroses and chronic infections of the kidney pelvis convinces me that, in the past, we have given too little attention to this lesion.

Several factors have contributed to this neglect. The chief one has lain in the traditional belief even of the urologist that, if an ordinary renal catheter passes easily to the kidney, there can be no organic disease of the ureteral walls capable of causing urinary stasis. This assumption is the more astounding when we consider what he has taught us about the diagnosis of urethral stricture.

Another source of error lies in wrong interpretations of pyelo-ureterograms. For years the urologist has been failing to recognize stricture cases and unless his ureterograms have shown gross changes they have been interpreted as normal. Unfortunately, also, the roentgenologist has been influenced to join him in overlooking many of the lesser deformities and interpreting the picture as normal.

HYDRONEPHROSIS

The study of ureteral stricture demonstrates many facts which seem to run contrary to logic and to our preconceived notions. In the first place, the partial obstruction of a stricture area, which at times may become temporarily complete, offers the ideal condition for the formation of a hydronephrosis, and yet we see many strictures causing severe renal symptoms but associated with a kidney pelvis smaller than normal. Again with a stricture near the vesical end one would expect to find the tract above uniformly dilated, as frequently occurs, but not infrequently one finds that the dilatation has taken place chiefly in the calyces at the expense of the kidney cortex. In other cases the cortex and kidney function are not appreciably affected, because the dilatation has occured almost entirely in the pelvis, or again in the ureter.

[1] "We must, with better discrimination, call many of our cases hitherto labeled 'pyonephroses' and 'hydronephroses' by the proper name 'stricture of the ureter' and then describe the secondary changes produced by the accumulation of urine or pus in the upper urinary tract. If the disease is thus properly recognized and classified as a stricture, the stricture will then be sought out and treated, while as long as such names as 'pyonephrosis' and 'hydronephrosis' are current, just so long will surgeons be content to operate for the relief of the accumulation, or to sacrifice the kidney, neglecting the true cause of the disease. The physiological value of such an obstructed kidney has been repeatedly demonstrated; for, even after the blockade has existed for many months the kidney may resume a remarkable degree of activity, and if it is the only kidney it may still suffice to prolong life." (Stricture of the Ureter. Howard A. Kelly, J. Am. M. Ass., 1902, Aug. 16).

[1] Read before the Interstate Postgraduate Assembly of America, St. Paul, Minnesota, October 13, 1925.

Fig. 1. Illustrating stricture 15 millimeters above ureteral os with upper tract holding 200 cubic centimeters. The patient never had symptoms referable to the urinary tract until, during convalescence from an acute lobar pneumonia, she developed an acute staphylococcus aureus infection of this hydronephrotic kidney. Dilatation of bilateral stricture, the right kidney having a capacity of 15 cubic centimeters with sterile urine. Uncomplicated pregnancy and delivery 2 years later.

Fig. 2. Composite photograph showing positions of kidney with patient in dorsal and sitting positions. Note the 58 cubic centimeter pelvis and lack of reflux along the catheter. After three dilatations of two stricture areas in the lower ureter there was marked improvement in the general health, and thick purulent urine was changed to almost clear urine macroscopically, but a colon bacillus infection persisted. One year later the patient became pregnant and in view of bilateral stricture and the best work being done by this kidney, it was thought wise to give better drainage by a kidney fixation. This was done in the fourth month of pregnancy, and without further treatment the urine became sterile and pregnancy continued to term without complications. There were no pathological signs about the upper ureter and this was probably a case of secondary stasis at the pelviureteral junction due to extreme mobility of the kidney and enlarged pelvis, and valvelike action on the upper ureter from drag or lateral pressure.

A patient may have complained for years of symptoms referable to disease in one kidney, and on investigation one may find on this side a kidney pelvis with practically normal outlines, while on the symptomless side there is found a large hydronephrotic pelvis. Differential functional tests may reveal in one case that the symptom-producing kidney is doing the better work, while in the next case with apparently the same history and urographic findings, the grossly dilated kidney of the symptomless side is found to have the better function.

There is no dependable relation between the patient's symptoms, the size of the kidney pelvis and the functional value of the two kidneys, and the only safe practice, in the presence of a stricture and renal symptoms or damage on one side, is to make a careful study of both sides.

In a recent study[1] of end-results in 100 cases of ureteral stricture, I reported finding 34 patients with a hydronephrosis content of 15 cubic centimeters or more. In 21 (62 per cent) of these, the urine was sterile to culture.

[1] J. Urol., 1924, xii, 295.

Fig. 3. Illustrating ureteral stricture in the broad ligament region, pyelitis, and invalidism of 1 year duration. Rapid cessation of symptoms after dilatation of the lower stricture area. A heavy pyuria changed to macroscopically clear urine in which persisted a few pus cells and a light colon bacillus infection. Repeated urograms showed the long narrow area above the dilated abdominal spindle, probably representing a ureteritis or periureteritis secondary to the renal infection. A large bulb near the catheter tip detects this diffuse area of narrowing. After more thorough dilatation of this upper area the urine became leucocyte free but still yielded a colon bacillus culture, probably indicating a lack of perfect drainage.

In 2 patients, with left-sided hydronephroses of 340 and 360 cubic centimeters respectively, the urine was negative to culture and gave no evidence of inflammation. It is this frequent finding of hydronephrosis, sometimes of marked degree, without any evidence of infection in the urine, that strongly supports my view, so much at variance with most

Fig. 4. Shadow of X-ray catheter retraced in pelvis to show that the bulb, placed 3 centimeters back of the tip, has passed over into the pelvis. This film was taken 3 years after the difficult task of establishing good ureteral drainage for the patient's only kidney, which had been operated on 3 times within 5 months for recurring calculus formation. (See Ureteral stricture: report of unusual case, illustrating influence on formation of urinary calculi and on recurring calculi. J. Am. M. Ass., 1924, lxxxii, 509.) After good drainage was established, the urine which had shown a triple infection, became perfectly clear. Four times in the succeeding 3 years the patient returned with headache, coated tongue, anorexia, and sense of fullness in the kidney region. Each time there was pus and a colon bacillus infection in the urine. Each time the patient returned 2 weeks later with normal urine, after one dilatation, a striking demonstration of the value of good drainage. In addition to the two original strictures in the lower ureter there was infiltration and a bad angle of insertion at the pelviureteral region consequent on the previous infection and three operations with drainage. Note the outward deflection of the upper ureter. Note phleboliths in broad ligament regions, probably showing former inflammation.

urologists, that ureteral stricture is usually the primary lesion in the urinary tract, and that the infection, when present, is secondary and due to urinary stasis caused by the stricture.

Fig. 5. Each of two urograms showed the apparent "kinks" near the kidney. Symptoms relieved after dilatation of the stricture area in the iliac gland region. Pelvis and ureter held 13 cubic centimeters.

CHRONIC INFECTIONS OF THE KIDNEY PELVIS

The limits of space and time forbid a discussion of kidney infections in general, and it is my purpose to speak only of those chronic infections seen in the daily routine of the urologist and usually classified as pyelitis, infected hydronephrosis, and pyonephrosis. The recent literature shows that urologists are gradually awakening to the importance of defective drainage as a factor in such infections.

Although the average acute pyelitis should be looked upon as a medical rather than a urological problem, active urological investigation should not be too long delayed if the disease tends to become chronic or if it recurs. In such cases some form of obstruction is usually present, and in the vast majority of cases this will be found to be due to ureteral stricture, a condition which can be treated only by those familiar with urological methods. This rule applies to the chronic or recurring pyelitis of adults, of the pregnant and puerperal periods, and in children.

I need not remind the urologists that the treatment of chronic pyelitis has presented a chapter in their activities over which they have pondered with no great enthusiasm. Formerly we rather dreaded to undertake such a case. Today with a clear understanding of the question of drainage, we welcome the problem presented by the victim of a chronic pyelitis; and in the majority of cases we can, after the preliminary investigation, give the patient a fairly accurate prognosis as to the time of recovery, and as to whether it can be brought about by simple urological methods, or whether these will have to be supplemented by an operation. Years ago it was noted that a pyelitis sometimes cleared after a mere investigation with a plain catheter. Albarran in the early days advised the use of a permanent ureteral catheter for drainage, a procedure especially valuable in carrying a patient over a severe crisis, and particularly useful in pregnant women in whom the abnormally high temperature occasionally seen may threaten evil consequences to both mother and fetus.

For the last 20 years there has been increasing use of pelvic lavage in these chronic infections, and not infrequently an infection of several months' or years' duration has been seen to disappear like magic after the first or second lavage.

Too often, however, the lavage treatment, regardless of the antiseptic used, has been a prolonged ordeal, not infrequently punctuated with a subsequent "ureteral" chill and fever. It was the serious contemplation of this unfavorable reaction, which often left the patient with a fresh pyelitis and marked prostration, requiring a week for recovery to the previous level of normal temperature, which led me to the systematic investigation in all cases of chronic pyelitis for a possible area of infiltration in the ureter. For the past 3 or 4 years I have tentatively given up the lavage with antiseptics in the treatment of pyelitis and get far better results with drainage alone than formerly with antiseptics and the incidental drainage afforded by the use of the plain catheter.

It was this incidental drainage obtained by the passage of a plain catheter that accounted

Fig. 6. Illustrating poor drainage due to enlarged pelvis and kidney mobility. Much backache and periodic Dietl's crises over a period of 20 years. After dilatation of the stricture area in the broad ligament region ithe patent was much relieved while in the recumbent position, and had no further Dietl's crises. Walking and active housework caused considerable pain in the upper right flank, for which the patient submitted to nephropexy 2½ years after the ureteral dilatation. No adhesions and no infiltration about the pelviureteral region. The periureteral veins were varicose. The pelviureteral lumen took easily an 18 Fr. dilator passed down from the pelvis.

Fig. 7. Illustrating patient with bilateral stricture, bilateral hydronephrosis, calculus in left pelvis, sterile urine. Note (a) ureterovesical orifice, (b) stricture in broad ligament region, (c) stricture at iliac gland region, slightly dilated abdominal ureter, right hydronephrosis of 17 cubic centimeters.

for the occasional cure of a pyelitis during the preliminary investigations of an infected kidney, just as it was the trauma caused by the plain catheter that induced local œdema and a flareback in the unfortunate patient who had a stricture of too great density to be sufficiently dilated by it. The addition of irritating antiseptics that cannot readily escape, when there is œdema of the stricture area and partial retention, probably does more harm than good.

Whether it will be an advantage to add the antiseptic lavage treatment after establishing partial drainage by the first one or two dilatations remains to be determined by time and further observation.

Urologists have long speculated on the cause of the mild pyelitis so often found in the other kidney. For this, various factors have been held accountable—injury to the second kidney caused by compensatory overwork, high temperature, and massive doses of systemic organisms, incident to the disease of the kidney showing the major symptoms. Experience, however, offers a more logical explanation in demonstrating that stricture is practically always a bilateral disease.

In the end-result study above referred to, we found infection in one or both kidneys in 34 of the 100 patients. In 25 (74 per cent) this cleared up after the institution of better ureteral drainage. Of the 9 cases failing to show sterile urine after ureteral treatments, in 2 nephrectomy was necessary for advanced

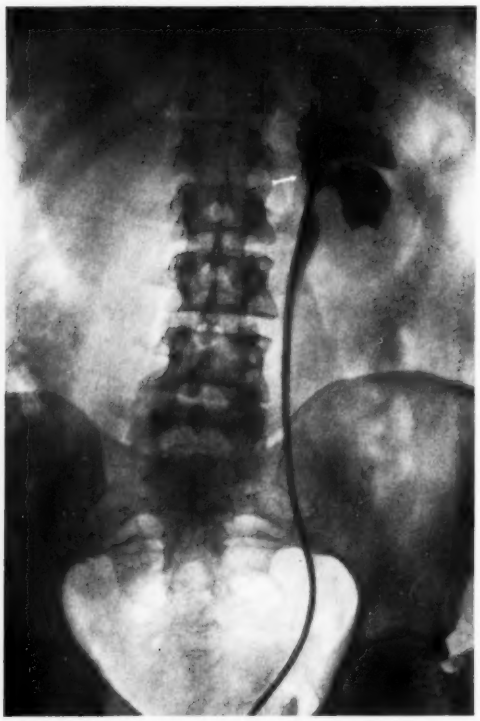

Fig. 8. Same patient as that in Fig. 7. Note catheter tip impacted against stone in left pelvis. Scratch marks on wax tip. Note narrow pelviureteral junction, a stricture probably due to irritation of the pelvic stone and to possible previous renal infection. Hydronephrosis of 45 cubic centimeters. Incomplete filling of ureter, but note dilated upper abdominal portion. Compare with Figure 12 taken 3 months after operation.

pyonephrosis, and in the other 7 improvement in the real drainage brought about relief of the urinary tract symptoms and enabled the patients to report after a 5-year interval that they were "cured" or "much better" in general health. This study was based on the history records and the first 100 answers to questionnaires sent to my first 300 ureteral stricture patients, all of whom were treated between 1910 and 1918. It is evident that in opening a new field of work one first meets with many neglected cases and therefore with a much higher percentage of cases presenting advanced lesions and complications than is found after familiarity with the disease has enabled one to diagnose the early cases.

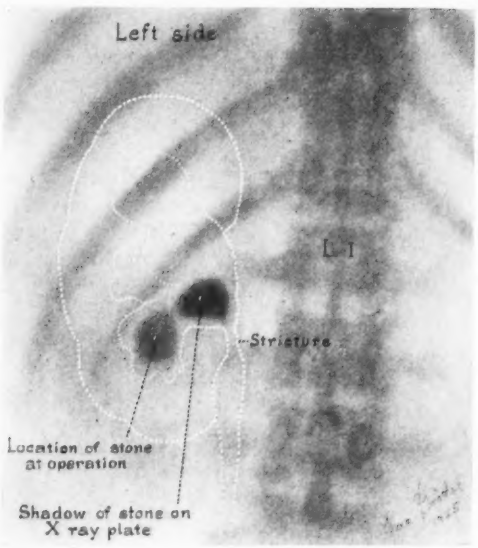

Fig. 9. Illustrating change of position of stone as found at operation.

An analysis of 100 consecutive cases diagnosed as ureteral stricture between June 1 and December 1, 1919, showed that in 20 one or both kidney pelves were infected, and I think this represents fairly accurately the proportion of kidney infections due to stasis from ureteral stricture. Another 50 per cent will show in the catheterized bladder urine such evidences of a lesion in the urinary tract as a few leucocytes, a few erythrocytes, a trace of albumin, or an occasional cast. In 30 per cent the urine is absolutely normal. The presence of normal or approximately normal urine in 80 per cent of ureteral strictures is one of the chief reasons why, in the past, so many patients with symptoms suggestive of a urinary tract lesion have been subjected to useless operations, rest cures, gastro-intestinal and other forms of medical treatment, when a thorough urological examination *in spite of negative urinary findings* might have led to a correct diagnosis and fruitful treatment.

We have seen that in our first 34 cases of chronic kidney infection we obtained a sterile urine by improving the drainage in only 74 per cent, while in 7 (20 per cent) we had to be satisfied with a goal short of sterile urine, and

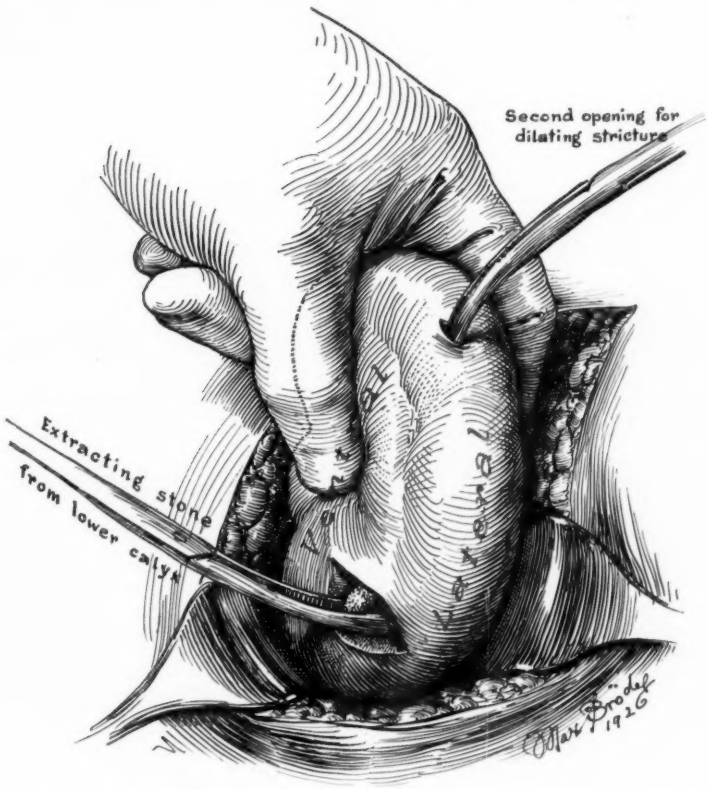

Fig. 10. At operation the pelvis was found to be of the intrarenal type, see Figure 8, and there was dense infiltration of the peripelvic fat. Two large veins traversed the posterior surface of the pelvis, and the anterior surface was so densely covered by infiltrated fat that I decided to explore the kidney through a cortex opening. The curved artery forceps was plunged through the base of a pyramid and spread sufficiently to admit the index finger. The upper and middle calyces and the funnel shaped pelvis were explored, but the stone was not felt and the finger could scarcely enter the narrow neck of the lower calyx. A curved uterine sound entered the lower calyx and found the stone. A counter opening was then made through the cortex directly on the stone.

in 2 (6 per cent), nephrectomy was necessary. As has been explained, this list contained a large proportion of neglected and far advanced cases, and we should get far better results in dealing with patients who have the benefit of an early diagnosis. Moreover, with early diagnosis and treatment of ureteral stricture, we are undoubtedly preventing many potential kidney infections.

There will always be the occasional patient with ureteral stricture in whom the symptoms of hydronephrosis or pyelitis cannot be entirely relieved by ureteral dilatation alone. As we have seen, ureteral stricture may be an insidious disease, and the patient may develop advanced kidney lesions before being aware of any illness. At times the first intimation of trouble is the sudden infection of what on investigation proves to be a very large hydronephrotic kidney which has undoubtedly been undergoing degenerative processes for months or years (Fig. 1).

Examples of secondary pathological conditions associated with ureteral stricture and

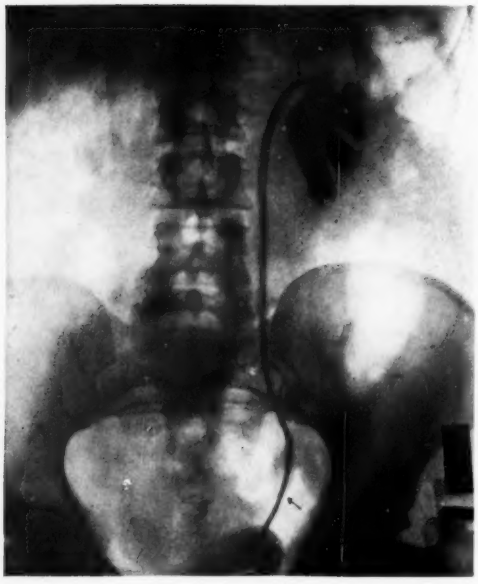

Fig. 11. Urogram study 3 months after operation. Note the marked downward displacement of the kidney as compared with the position shown in Figure 8. Pelvis rather smaller than before operation, holding 20 cubic centimeters as compared with 45 cubic centimeters before operation. Narrow area in upper ureter but free reflux of NaI solution down to lower stricture area. Ureter incompletely filled. Pelvis shadow below tip of twelfth rib. Compare Figure 8.

Criticism: Two Dakin tubes were left in the upper cortex opening for postoperative irrigation because of possible bleeding. If indicated at all they should have been left in the lower cortex opening, to prevent the bending downward of the replaced kidney. At operation, the kidney should always be replaced with great care and the foot of the bed should be elevated for 2 or 3 days until the kidney gets its highest fixation by adhesions. Patient free from symptoms. Urine negative to culture.

causing a persistence of hydronephrosis or symptoms of pyelitis after good drainage had been established in the original stricture site in the lower ureter are as follows: Hydronephrotic pelvis associated with an upper ureter which has retained a fairly fixed position, may readily lead to impaired drainage by a dragging, kinking, or lateral compression of the pelviureteral region (Fig. 2). This condition is exaggerated if the naturally narrow upper ureteral segment is the seat of infiltration due to the chronic inflammation sometimes present in the sterile and more often in the infected cases.

Fig. 12. Illustrating stone particles left in lower calyx after pyelolithotomy for a large mucocalcareous mass with colon bacillus infection. Postoperative lumbar drainage and lavage for 3 weeks. At the end of 5 weeks the urine was negative on microscopic and culture tests in spite of the small stone particles in the lower calyx. Preliminary dilatation of bilateral ureteral stricture. A complete examination at the end of 1 year revealed the same stone particles, normal urine, and freedom from symptoms.

The upper ureter may be suspended, kinked, or laterally compressed by the adhesions or bands of a periureteritis or perinephritis consequent upon a pyelitis, an infected hydronephrosis, an infected nephrolithiasis, or a former operation.

The pelviureteral channel may preserve its original normal axis, but the drainage be seriously hampered by narrowing of the upper lumen due to an actual chronic infiltration of the ureteral walls, in other words, by a local ureteral stricture of the upper segment (Fig. 3). I rarely see a stricture in the upper ureter to which I ascribe the same etiology as to those occurring so frequently in the lower ureter. If the roentgenogram reveals a calcified gland near the stricture in the upper ureter this points strongly to an origin from some focal infection, such as is usually the cause of stricture of the lower ureter; but I

believe that most of the infiltrations found in the upper ureter can be ascribed to an extension of the inflammation from an infected pelvis, whether associated with an infected hydronephrosis, a pyelitis, a pyonephrosis, or a nephrolithiasis.

The point of great practical interest in cases with high stricture, when uncomplicated by an abnormal angle of insertion, is that in these good drainage can be secured by urological methods and without operation. The technique is slightly more difficult and requires greater care than for the lower strictures. The wax bulb must be placed within 2 or 3 centimeters of the catheter tip and the wire stylet, if used, must be partly withdrawn to give the catheter tip a flexibility that will favor its deflection by the kidney pelvis and thus prevent perforation.

With sufficient experience one can feel the bulb pass through the upper stricture and over into the kidney pelvis, and one can more easily detect the hang of the bulb coming out, and can accurately measure the distance from this area of resistance to the external urethral meatus. As a check on this method one can use a radiograph catheter and with a pyelo-ureterogram can determine whether the terminal 3 centimeters of the catheter carrying the bulb has actually passed into the pelvis (Fig. 4).

If it is not possible to dilate the upper stricture by the vesical route, an operation to expose the kidney pelvis and dilate by the retrograde route is indicated on the same principle that one has occasionally to apply in treating a stricture low in the ureter through an extraperitoneal exposure.

The pyelo-ureterogram is our greatest help in a study to determine whether a given case of hydronephrosis or pyelitis is going to be cured by urological methods alone or whether operation will be required. It must be remembered, however, that urograms, like a gastro-intestinal series of films, may be quite misleading, and the man who studies them most carefully, and in the light of all available knowledge, is the one least willing to make a positive diagnosis on the urogram alone. Operations are being done daily because of such misinterpretations, whereas a thorough

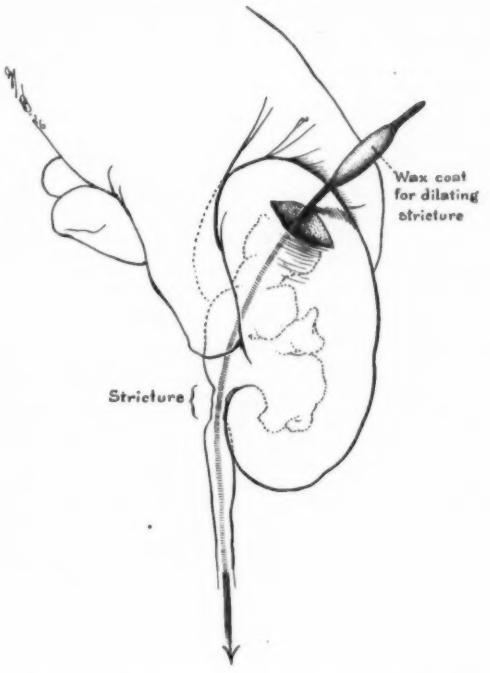

Fig. 13. After removal of the stone an attempt was made to dilate the narrow pelvi-ureteral junction. The uterine sound, a fine silver probe, a pointed renal catheter, and a fine pointed dilating bougie each failed to enter the ureter. Fortunately we had introduced a catheter from below before beginning the operation, for the purpose of studying the reno-ureteral relations by injection of methylene blue salt solution. An assistant now reintroduced a wire stylet and pushed the catheter up through the pelvis and out of the upper cortex opening. I built up a large wax bulb, 5 millimeters in diameter, near the catheter tip and the assistant withdrew this through the bladder.

investigation would have led to a correct diagnosis and a more rational and often a less radical line of treatment. This statement applies with particular force in the field under discussion. If ureteral stricture is the chief etiological factor in poor urinary drainage and in most cases of hydronephrosis and chronic renal infection, it is evident that our past methods of dealing directly with the renal disease and overlooking its most frequent cause have been woefully defective.

Thorough investigation will make it clear that in many cases the defective drainage is due to stricture in the lower ureter, although

the urogram shows apparent secondary pathological changes in the kidney region, and may lead one to predict eventual operation as necessary. It is surprising in how many of these instances a few ureteral dilatations may suffice to produce perfect drainage, as indicated by the disappearance of symptoms, clearing up of the infection, and marked increase in renal function (Fig. 5).

In others the ureteral stricture dilatation may yield only fair amelioration of symptoms and we are forced to accept the urogram indications and operate to clear up the secondary pathological conditions in the renal or upper ureteral region. But even in this group our preliminary ureteral dilatations will usually have placed the patient in much better condition for operation and have greatly enhanced the ultimate success of the operation (Fig. 6).

In a third very small group we apparently make no progress by thorough dilatation of the lower strictures because the secondary conditions about the kidney have become so advanced that the interference with drainage is now located almost entirely in this region. Nephrectomy is often indicated in this group, and if the kidney is worth saving by conservative operation we have often advanced the success of this by preliminary dilatation. Inasmuch as stricture is practically always bilateral we have helped most in this group by deferring operation until the better side has been improved by drainage.

URINARY CALCULUS

In the past 10 years I have studied the relationship of ureteral stricture to calculus formation in more than 200 cases of renal and ureteral calculi and have found that the two conditions are associated in considerably more than 90 per cent of the cases.

We must admit at once that an infected calculus kidney is prone to cause inflammation of the walls and of the surrounding tissues of the upper ureter. We must also admit that a calculus forming in the kidney and becoming wedged in any portion of the ureter may set up local inflammatory reaction and thus become encased in a scar tissue or stricture area.

Careful study of the subject, however, has convinced me that in most cases of urinary calculus in the upper tract, ureteral stricture is the primary lesion and calculus formation is a secondary process due in large measure to impaired drainage.

We find calculus formation in only about one-twelfth of all our stricture cases, a strong indication that factors other than stricture and stasis play an important part in stone formation. While stricture is practically always bilateral, and while I have claimed that this fact probably accounts for the relative frequency of bilateral calculus, yet the incidence of bilateral calculus is not nearly as high as we would anticipate if we attempt to discard other factors as having an important rôle in stone formation. Clinical experience in this field has led to the following conclusions[1]: (a) "The presence of a calculus in the kidney or ureter is presumptive evidence of a co-existent ureteral stricture; (b) ureteral stricture is probably of blood-borne origin; hence, as one would anticipate under such circumstances, we find that it is practically always bilateral; (c) the symptoms and many of the pathological changes which we formerly ascribed to the presence of a stone are probably more often the result of stasis due to the stricture." If these conclusions are verified by the work of others, as the current literature on the subject seems to promise, we shall have the key to many of the problems associated with calculus that have puzzled urologists and medical men in general, and we shall have revolutionized our attitude toward the therapeutics of renal and ureteral calculus.

Instead of looking upon the presence of a calculus as a purely surgical problem we shall realize that we are dealing with an intricate problem of drainage, one which affects not only the side harboring the calculus, but the opposite side as well, and that back of this problem of bilateral ureteral drainage we usually have the problem of a focal infection.

By early diagnosis and treatment of ureteral stricture, including the eradication of the causative focal infection, we shall greatly reduce the incidence of stone formation.

[1]Radiographic evidence of the association of ureteral stricture and urinary calculi. J. Urol., 1925, xiii ,497.

In nephrolithiasis and ureterolithiasis operations the intelligent management of the drainage problems before, during, and after operation will provide our best insurance against the recurrence of stone on the side operated upon, and against the future development of stone on the opposite side (Figs. 7 to 11).

Every surgeon experienced in renal calculus work knows how we have dreaded the establishment of lumbar drainage because of the dangers of persistent fistula, infection by extraneous organisms, and consequent recurrence of calculus formation. Rovsing[1] has emphasized these dangers and even goes so far as to advise "nephrectomy in cases of unilateral infection with urea-decomposing micro-organisms, and in other cases of pyonephrosis in which drainage of the pyonephrosis cannot be avoided." He presents the following table of nephrolithotomies:

	Cases	Recurrences	Per cent
Total number	109	44	40.36
Aseptic cases	58	15	25.86
Infected with bacillus coli	27	10	37.03
Infected with urea decomposing microbes (staphylococci, proteus hausseri)	24	19	79.16

With the control of drainage made possible through ureteral stricture work we now deliberately establish free lumbar drainage in (a) any case in which we suspect that our pre-operative dilatations have not been adequate; (b) any case in which we suspect small particles of stone have been left; and (c) any case in which we fear blood clots may remain.

In the first group we attempt to keep the lumbar drain in place for weeks, if necessary, until we can make certain of adequate post-operative ureteral dilatation through the vesical route. Experience has shown that as soon as we establish good ureteral drainage the lumbar fistula closes promptly, and most of these patients are dismissed with clear urine free from organisms and pus cells, even in cases still carrying a foreign body in the kidney in the form of minute stone particles which we have missed at operation (Fig. 12).

[1]Secondo Congr. della Societa internaz. di urol., Roma, 1924, April 24–26.

ESSENTIAL HÆMATURIA

Until the publication 3 years ago of my paper entitled "Ureteral Stricture, An Important Etiological Factor in the So-called Essential Hæmaturias," the profession had universally adopted the viewpoint expressed by Israel 20 years previously that these hæmaturias are due to organic changes in the kidney substance. In subscribing to this view I added the newly discovered fact that these nephritis changes are associated with ureteral stricture. I held that the chronic changes in the kidney are usually secondary to the stasis caused by the stricture, and that in some instances the kidney lesion is probably due to the same hæmatogenous infection that has caused the stricture. That the bleeding usually represents injury caused by the back pressure is shown by the large percentage of "cures" obtained by the one therapeutic measure of restoring good drainage by dilatation of the ureteral stricture. That repeated direct injury to the kidney substance by toxins coming from a focal infection may be the chief cause of the bleeding in some instances is suggested by the fact that a few of these patients continue to bleed after thorough dilatation of the stricture and until an area of focal infection has been found and removed.

I reported 18 cases with 25 bleeding kidneys (7 of the patients showing bilateral hæmaturia) in which restoration of good drainage and treatment of the areas of focal infection had given far better results than we had before attained by methods which often involved operative procedures. In the past 3 years I have treated about as many more such patients with excellent results, and the literature shows that others are doing likewise.

CONGENITAL MALFORMATIONS

With the development of renal catheterization, congenital malformations of the upper urinary tract, formerly diagnosed only at operation or autopsy, are now known to be far less rare than was supposed.

Because of the comparative frequency with which these malformations are now discovered when a search is being made for the cause of renal symptoms, it is generally stated that the

malformation, when present, predisposes to such diseases as hydronephrosis, pyelitis, pyonephrosis, and calculus.

My experience with about 30 of these cases in patients with congenital malformations shows that the condition is nearly always associated with ureteral stricture, and it is only reasonable to suppose that the stricture with its impeded drainage, rather than the malformation *per se*, is the cause of the secondary disease.

These patients with congenital malformations and secondary lesions in the kidney should have the same treatment as those with a normally formed kidney which has become diseased because of the stasis due to stricture —the establishment of thorough drainage.

MULTIPLE ABORTIONS DUE TO RENAL INSUFFICIENCY

In a recent publication[1] attention was called to that important group of cases in which the woman is unable to carry a fetus to term apparently because of renal insufficiency; and to the fact that in many of these cases bilateral ureteral stricture is found, associated sometimes with serious renal disease.

I reported 3 cases apparently belonging to this group in which, after the establishment of good ureteral drainage, the general health and renal function improved so much that the women were able to go to term and were delivered of healthy children.

[1]Ureteral stricture in obstetrics; with special reference to multiple abortions (renal) and to pyelitis of pregnancy. Am. J. Obst. & Gynec., 1925, ix, 47.

MEDICAL NEPHRITIS

Just what part defective drainage may have in the renal diseases usually considered as purely medical offers a fertile field for future research.

Until urologists come to a better understanding of the frequency of ureteral stricture and its significance in the renal diseases usually considered surgical, they cannot expect internists to co-operate in determining whether stricture with its impaired drainage is a source of a certain number of cases of chronic nephritis formerly considered amenable to medical measures only.

From experience with many patients showing a clinical picture most suggestive of what is usually considered an indication of a more or less hopeless chronic nephritis, I am confident that in the future our first concern in these cases will be to see whether the kidneys are having good drainage.

We do the average patient no harm in the investigation for the possible presence of ureteral stricture, and if stricture is found it does not seem unreasonable to state that the establishment of better drainage is the first and most important step in the expectant treatment.

THE TREATMENT OF PYLEPHLEBITIS OF APPENDICULAR ORIGIN

With a Report of Three Cases of Ligation of the Portal Vein

By RALPH COLP, M.D., F.A.C.S., New York
From the surgical service of Dr. Edwin Beer, Mt. Sinai Hospital, New York

THE dreaded complication of suppurative pylephlebitis occurring in acute appendicitis is now rare because the great majority of cases are operated upon earlier and with better surgical technique than they were formerly; yet it occasionally occurs, and its proper treatment is still a mooted question. When Fitz (10), in 1886, tabulated his autopsy findings in patients dying from acute appendicitis, pylephlebitis was not an unusual complication, occurring 11 times in 257 cases. Armstrong (1), in 1897, found postmortem pylephlebitis and abscess of the liver in more than 5 per cent of 546 examinations made of patients dying of appendicitis. In Gerster's (12) experience, based on his observations of 1,189 cases in which an operation had been done for acute appendicitis, at the Mt. Sinai Hospital, New York, from 1892 to 1901, this complication occurred 9 times. More recently Braun (Zwickau, 4), reported it as occurring 8 times in 600 cases; A. and E. Moschcowitz (19), 7 times in 1,529 cases; and Giertz (13), 4 times in 533 cases. From 1916 to 1925 there were 2,841 patients with acute appendicitis admitted to the surgical wards of the Mt. Sinai Hospital, New York, and in this number the diagnosis of appendicular pylephlebitis was made in 9 cases; about three-tenths of 1 per cent.

The pathology of this untoward complication is variable and inconstant, and because of this the treatment is unsatisfactory. As a rule, the appendix is acutely inflamed, red and turgid, often gangrenous, and commonly complicated by abscess. The smaller venous radicles of the mesenteriolum are usually thrombotic, and the thrombi may contain bacteria (26). Cases have been reported in which the appendix appeared grossly normal, and Bier (4) cites an interesting case in which at autopsy the portal vein contained a thrombus loaded with streptococci, while the appendix showed but a mild infiltration with the same organism. In some instances, these infected thrombi may shoot bacterial emboli into the liver, forming multiple metastatic abscesses while the portal vein and its tributaries remain normal. More commonly, there is a direct extension of the infected clot into the ileocolic vein and hence into the larger venous channels, finally gaining the intralobular veins of the liver, about which abscesses containing greenish yellow pus are formed. The right lobe is more commonly involved. In some cases, the thrombophlebitis remains localized in the ileocolic vein which may be felt retroperitoneally as a firm, hard strand often reaching the diameter of the little finger; occasionally, the inflammation spreads beyond the vessel wall, forming a perivenous abscess, or a retroperitoneal phlegmon. But the portal vein is not the only path by which infection may enter the liver. The lymphatics of the portal fissure and the retrocæcal and retrocolonic spaces, and extension of suppuration in the subhepatic or subphrenic spaces may be responsible also for hepatic abscesses.

The pathological picture of the portal vein varies. Externally it may appear almost normal except for a slight œdema (Case 3), or there may be a definite enlargement with congestion and engorgement, the inflammatory products extending between the layers of the gastrohepatic omentum and into the adjacent lymph nodes, matting the structures to such a degree that isolation of the portal vein may be extremely difficult (Cases 1 and 2). The lumen of the vessel may be filled with a friable, sanguinopurulent clot which may autolize into a dirty-looking, greenish-yellow viscid material, partly or completely obstructing the vein. In rarer instances, the vein wall shows purulent infiltration, and it may even be bathed in pus.

Pylephlebitis complicating acute appendicitis may be present at the time of operation

or subsequently develop within 24 hours, or as late as 43 days after. The onset is ushered in, as a rule, by a severe shaking chill and a rise of temperature to 104 or 105 degrees. These chills may then recur daily. Gerster (12) states: "Chills accompanied by a rapid rise in temperature during the course of an appendicitis, however mild as to local symptoms, may and usually do signify the entrance of a septic material into the portal and general circulation. It must be looked upon as a sign of gravest importance." Jaundice may be present; and in many instances before the icterus is apparent clinically the bilirubin content of the blood serum may show a progressive increase (Case 3). The abdomen on physical examination may be soft and relaxed throughout with the local condition subsiding or even healed, while the liver, which may be tender to percussion, is often felt enlarged. Blood cultures as a rule are negative, because, according to Lenhartz (17), the bacillus coli which is usually responsible, either rarely breaks into the blood stream in these cases, or if it does, it is quickly destroyed there or in the liver. In other cases, early cultures of the blood may show a growth, and Lewis and Rosenow (18) have demonstrated clinically and experimentally what an important part infection plays in the production of pylephlebitis.

Most surgeons consider the prognosis of portal suppuration as invariably fatal. While the ultimate outlook is bad, it is not absolutely hopeless. There are patients with mild infection who undoubtedly get well (2 and 9). Petrén (21) was able to collect more than 20 histories of patients with liver abscess following appendicitis who recovered by operation, and the literature contains several reports of hepatic suppuration which resolved spontaneously. But since in a series of 1,340 autopsies (21) following acute appendicitis, liver abscess was partially responsible for 5 per cent of all deaths, the question naturally arises whether any treatment can reduce the incidence of this unpleasant complication.

It is universally granted that if all patients suffering from acute appendicitis were operated upon within the first 24 hours, this complication might never occur. Unfortunately, this desideratum is not always obtainable. It has been taught that a history of chill should excite suspicion of a possible pylephlebitis. Thalhimer (26) states: "Every case of acute appendicitis should be considered as an early case of potential pylephlebitis whether there is a history of chills or not. Consequently, the appendix and its neighborhood should always be carefully inspected for the presence of small thrombosed veins so that these can be dealt with." However, there are innumerable cases giving a history of chills in which operation discloses an acutely inflamed, gangrenous appendix with an œdematous mesentery often containing definitely thrombosed veins which, following appendicectomy, make an uneventful recovery. (A review of these cases will be published later.) In fact, Sonnenburg (23) believes that thrombotic veins are present in all acutely and chronically inflamed appendices. There are probably two reasons why pylephlebitis does not occur more frequently. One is the early ablation of the appendix as the primary bacterial focus; the other that the liver cells are capable of destroying a certain number of bacterial emboli. The real danger in pylephlebitis is not the suppurative thrombophlebitis per se, but the destruction of liver tissue by abscess formation to such an extent that death results from either sepsis or cholæmia. Therefore, any treatment instituted must be directed to safeguard the liver from vascular infection by occluding the veins carrying these organisms.

The indications for surgical therapy may be divided into the prophylactic, the treatment of frank phlebitis present at the time of operation, and a treatment of pylephlebitis manifesting itself after the operation.

It is very difficult to decide what should be done prophylactically if the mesentery of a gangrenous appendix does not bleed when cut because of thrombus formation. It must be granted academically that some cases with chills and friable thrombotic mesenteries will develop pylephlebitis. Yet the percentage is so exceedingly small (in our series of 2,703 cases less than three-tenths of 1 per cent) that actual damage rather than help might result from the various surgical measures

which have been advocated to deal with these infected thrombi. If, however, the case presents all the clinical symptoms of pylephlebitis, or at operation a suppurative phlebitis of the mesentery is evident, then a venous excision or ligation is certainly indicated, done preferably before the appendicectomy. Various surgical procedures have been advocated. Gerster (12) practiced incision and drainage of the infected thrombosed veins, Wilms (29) advised excision of the veins of the ileocœcal angle. Braun (5) recommended the ligation of the ileocolic vein, and Neuhof (20) suggested the occlusion of the portal.

Gerster (12), in 1903, discussing the treatment of pylephlebitis, stated: "When much necrosis is found it would be very desirable to expose and evacuate thrombosed veins. On account of their anatomical relations this is sometimes easy, oftener difficult and mostly impossible." And, in support of this statement, the following two cases are not without interest.

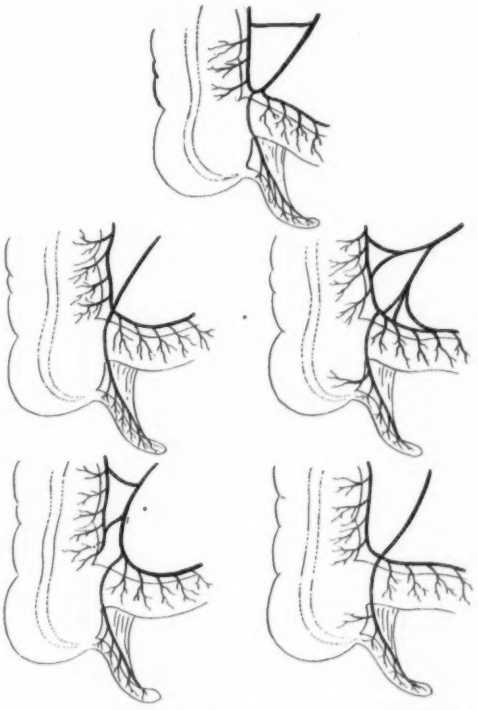

Fig. 1. Variations in the venous supply of the ileocæcal angle. (After Walcker.)

CASE 13. Perforated empyema of appendix; purulent thrombosis of vessels of appendix and neighboring cæcum; appendectomy; removal of mesenteriolum; incision and drainage of thrombosed veins; cured.

Isaac G., age 27 years, a presser, had never been ill until the present time. Thirty-six hours before admission he began to suffer with severe abdominal cramps; vomited repeatedly; was chilly at the onset. During his transportation to the hospital the abdominal pain subsided very materially. On admission, December 9, he looked very sick. His internal organs were normal; the abdomen was rigid and tender all over, but especially so in the right iliac fossa; free fluid in both flanks. Rectally, a tender area high up on the right side could be palpated; temperature 104 degrees F.; pulse rate 82. Diagnosis: acute appendicitis; peritonitis. Immediate laparotomy was done; free exudate was found in the peritoneal cavity; there was a localized, thick, tenacious, but odorless encapsulated exudate in the right iliac fossa below and external to the caput coli. The appendix was found internal and below the caput coli curled up in a semicircle. It was perforated, and from the hole, brownish pus exuded. The mesenteriolum was infiltrated with pus and the purulent infiltration extended up to the adjoining vessels of the cæcum. The appendix with its mesenteriolum was ligated and removed. The purulent veins of the caput were incised, curetted, and drained. During this part of the manipulation the cæcum was punctured and at once closed by Lembert sutures. Drainage of stump of mesenteriolum, appendix, and cæcal region; closure of the rest of the wound. The temperature fell after operation to 100 degrees F. and then rose to 102.2 degrees F. and continued for the next 10 days between 100 degrees and 101 degrees F. There was a profuse purulent discharge from the drainage opening for a week; thereafter rapid closure of the wound. The convalescence was interrupted by a rather severe attack of tonsillitis. Discharged cured, February 2, 1902.

CASE 14. Acute gangrenous appendicitis; thrombosis of veins of mesenteriolum of appendix and adjoining veins of cæcum; appendectomy; drainage of thrombosed veins; cured.

J. G., age 24 years, a canvasser, was never sick until 36 hours before his admission. During the first 12 hours he felt chilly at intervals and suffered with pains in the right iliac fossa; during the last 24 hours he had two severe chills and vomited repeatedly, the pain in the right iliac region remaining constant. On admission, April 26, 1902, temperature was 102.4 degrees F.; pulse 108. He was well nourished. Internal organs were normal. The lower half of the right rectus was slightly rigid. Exquisite

tenderness from McBurney's point downward and inward to the pubis, but no distinct mass was to be felt. Rectally, nothing except distended intestines could be palpated. Diagnosis: acute appendicitis; probably venous thrombosis. Immediate laparotomy was proceeded with. Just before taking the anæsthetic the patient had a very severe rigor. The appendix was located anteriorly to the caput coli, lying free and surrounded by omentum. It was 2.5 inches long, dusky in color, and completely gangrenous. The vessels of the mesenteriolum contained purulent thrombi. The vessels of the caput coli could be palpated as rigid cords. This rigidity extended well up along the ascending colon. The appendix was delivered from its omental bed, its mesenteriolum was deligated at as high a point as was possible, and the appendix, after its base had been ligated, was removed. In the stump of the mesenteriolum could be seen the purulent thrombi in the veins. The veins in the stump and in the adjoining portion of the cæcum were slit up and drained by gauze, and the wound was closed. The patient reacted well; temperature fell during the next 24 hours to 99 degrees F.; the pulse rate to 72; with chilly sensations it rose suddenly in the next 4 hours to 103 degrees F., pulse rate 92; it then declined rapidly to 97.8 degrees F. on the third day; thereafter it fluctuated between 99 degrees and 100 degrees F. There was a profuse purulent discharge from the drain opening for 10 days; thereafter the wound healed rapidly.

Wilms (29), in 1907, following the reasoning of Trendelenburg in ligating the ovarian (spermatic) veins in cases of puerperal pyæmia, suggested a ligation of the veins in the ileocolic angle. He advised a horizontal incision from the anterior superior spine to the rectus muscle and the insertion of the index finger under the lateral aspect of the ascending colon to loosen it with its mesentery and the lower intestine from the posterior abdominal wall. After division of the anterior leaflet of the peritoneum, the veins of the ileocæcal angle are carefully tied, omitting the ligature of the artery. Drainage is placed down to the cæcum in event of subsequent gangrene. This procedure was done on a male of 42, who gave a history of having had two chills and an appendicular abscess of 10 days' duration. The abscess was drained but on the third day there was a recurrence of three chills, and on the fourth day following the chills the operation described above was performed and the patient recovered. This operation is limited in its application and involves some danger of destroying the nourishment of the bowel wall. Sprengel (24) subsequently reported a case of a male of 29 who gave a 36-hour history of abdominal pain, and an appendicectomy with drainage was done for a perforated, gangrenous appendix. Eight days later fever and chills began, the latter recurring two and three times daily, while the abdomen remained soft and relaxed with complete absence of clinical jaundice. Thirteen days after, the "Wilms operation" was performed. It was rather difficult to isolate the veins of the ileocæcal angle because of the fatty retroperitoneal tissues. Chills continued at the rate of two and three a day and then ceased, but a cæcal fæcal fistula developed and the patient died 3 weeks after the operation. Autopsy disclosed a fistula of the ileum at the cæcum, and a thrombophlebitis of the superior and inferior mesenteric veins, and the finest branches of the portal, with multiple abscesses in the liver. It was quite evident that several veins in the mid-portion of the ileocæcal angle were not tied. A glance at the variation of the blood supply at the ileocæcal angle, as pictured by Walcker (27), shown in Figure 1, and Kelly (16), demonstrates the difficulty of successfully ligating all the venous channels.

In 1907 Braun, wishing to overcome the technical difficulties of the "Wilms operation," tried an unsuccessful ligation of the ileocolic vein. In 1913 he reported two successful cases. The ileocolic vein, which has only one branch opening laterally as a rule, is not difficult to expose, provided the ascending colon is drawn to the right, the transverse colon above and the small intestine to the left. The vein then is either seen or felt as a thrombosed cord running from the ileocæcal angle, obliquely upward to the right of the spine toward the corner of the transverse mesocolon and the mesentery of the small intestine. This vein is the only channel through which thrombi in acute appendicitis can travel, and if it is ligated early, the progress of the infection may be arrested. Some of the following cases given in abstract bear witness to its efficacy.

Braun (5). CASE 1. Male, aged 39, had pain in lower abdomen with chill. The following day he became icteric and the next day the pain and fever disappeared. In a few days the icterus was no longer

apparent. He had had two previous attacks in 2 months. At operation, through a transverse incision, a chronically inflamed appendix was found with an apical abscess, completely walled off. This was carefully packed and about 2 centimeters of the ileocolic vein were resected; no thrombi were found. The wound healed and the patient was discharged as cured.

CASE 2. Male, aged 27, for 14 days had abdominal pain; for past 8 days chills, but no jaundice. At operation, an appendicular abscess was drained and 8 centimeters of a thrombosed ileocolic vein were resected, the ligature passing through a thrombus which evidently filled the superior mesenteric vein. Cultures of the thrombus yielded innumerable colonies of bacillus coli. The convalescence was quite stormy; chills were present for 4 days and then disappeared, together with the icterus. The patient was discharged well.

Weil (28). CASE 1. Female, age not given, for 14 days had had pain in right lower quadrant and for days had two chills daily. Pararectal incision was made and a retroperitoneal abscess was found extending from the cæcum to the root of the mesentery, and in it the obliterated ileocæcal vein. The abscess was packed and the vein was ligated high, after which an appendicectomy was performed for a perforated gangrenous retrocæcal appendix. The postoperative course was stormy; after 3 weeks there was a cessation of the chills and in 10 weeks the patient was discharged as cured.

Sudeck (25). CASE 1. Female, age 12, was sick 8 days with abdominal pain with ten chills on the seventh day. Operation was done through a mid-line incision to find the mesenteric vein. This was present as a hard cord. The peritoneum was split, the cord followed up to its entrance through the transverse mesocolon where it was tied with catgut, but not excised. The appendix was then ablated and both wounds were packed. After operation, there was only one chill and the patient recovered. In this case, the superior mesenteric vein was ligated.

CASE 2. Male, age 57, had an appendicectomy without drainage for gangrenous appendix. Five days after operation, he had a chill and bacillus coli in the blood culture. For 6 days he had recurrent chills, seventh and eighth days none, with a return on the ninth. No peritonitis, no exudate were found. At secondary operation, the ileocolic and the superior mesenteric veins were enlarged to the diameter of the little finger, and the peritoneum over this was reddened. After incising the peritoneum, the surgeon found no definite venous thrombus, and believing that a purulent thrombolymphangitis was present, he simply packed the wound. Ten days later the patient died. An autopsy revealed a peritonitis at the site of tamponade, small thrombus in the mesenteric vein, and a large liver with multiple emboli in the smallest radicles of the portal vein. The condition was definitely thrombophlebitis. (In this case it would have been better not only to have tied off the vein, but to have incised and drained it.)

Fromme (11). Female, aged 12, for 4 weeks had shown a history of appendicitis, last 3 weeks of which from one to three chills were present daily. At operation, the liver was enlarged but no abscesses were evident. The appendix, which was inflamed and covered with omentum, was extirpated and upon dividing the mesoappendix a suppurative phlebitis was found. The ileocolic vein was felt as a hard cord, the size of a finger. Upon incising the posterior, parietal peritoneum in the region of the transverse mesocolon, an abscess was entered containing foul pus. Probing the cavity brought forth a brisk hæmorrhage either from the central end of the superior mesenteric or the portal vein itself. This was arrested by pressure. The case was finally discharged healed. (It is barely possible that in probing, a thrombus was dislodged which was washed out by active hæmorrhage.)

Hempel (14). CASE 1. Male, age 51, had an operation 9 days after first chill. Ileocolic vein was distinctly palpable; after ligature temperature fell. The following days he had several chills with eventual recovery.

CASE 2. A second patient had an operation 10 days after the first chill and disclosed suppurative peritonitis, a thickened ileocolic vein, and a perivenous abscess. The vein was ligated. Although there were no further chills, the patient died of peritonitis.

CASE 3. In a third patient, operation was done 5 days after first chill. There was an old inflammation of the appendix. The ileocolic vein was thickened and filled with a purulent thrombus. Exitus, 18 days after operation from suppurative peritonitis.

Brutt (7) states that in 3 cases the thrombosed ileocolic vein was ligated; in two, several days after operation, through a new perirectal incision; both died. An autopsy showed the ligature intact with a phlebitis extending to the portal. In the third case the ileocolic was ligated at the time of appendectomy, and the patient who had had two chills and a bacillus coli in the blood culture, recovered. (These three cases are from a series of 15 cases of pylephlebitis which occurred in the course of 2,500 cases of acute appendicitis treated at the Eppendorfer Clinic.) The course was always fatal except in the case herewith recorded.

It becomes evident from some of the records of the foregoing cases, and other autopsy findings, that the infection may have already spread beyond the confines of the ileocolic vein at the time of its resection or ligation. In these cases, or in those in which the thrombophlebitis may involve the radicles of the ileocæcal angle only, could better results be obtained in preventing infection reaching the liver by a primary occlusion of the portal vein? It has been the general consensus of opinion that sudden occlusion of the portal

vein usually results in death. Cases surviving portal vein ligation are extremely rare if the literature is an index (6 and 8). In fact, in a series of 21 cases of primary portal thrombosis, collected by Lewis and Rosenow (18) only 4 recovered following a resection of gangrenous intestine for a circulatory ileus caused by the portal occlusion. Kehr (15) states that the portal vein may be ligated only if sufficient collateral circulation is present. However, secondary thromboses of the portal vein are not rare, and are compatible with life, but the process which has caused this, is presumably gradual with plenty of opportunity for the development of collateral circulation.

It was Charpy who first described the veins in the gastrohepatic omentum but Pick (22) emphasized their real importance as additional anastomotic channels in carrying blood to the liver in portal obliteration: he gave them the name of "hepatopetal veins." Believing that a beginning thrombosis of the portal vein might cause a full development of these hepatopetal veins in the gastrohepatic omentum to such an extent that the porta could be occluded, Neuhof (20) suggested the ligation of the portal vein combined with an omentopexy in cases of pylephlebitis. As noted in Neuhof's experimental studies and the autopsy records of Winternitz (30), such an occlusion has but little effect upon the liver parenchyma, because the hepatic artery supplies blood via anastomosis between the two systems, and there is an extensive collateral circulation developed in the hepatoduodenal ligament.

The portal vein is very large, varying in length from 5 to 12 centimeters, with an average diameter of 1 to 1.8 centimeters. It differs from other veins in that its blood contains the products and poisons of the gastrointestinal tract and the spleen. The vein is usually formed by two, three, or four branches, i.e., the gastric, the splenic, the inferior mesenteric and superior mesenteric veins. The superior mesenteric and splenic veins unite normally to make the portal, the inferior mesenteric emptying into the splenic. It is not uncommon for the superior mesenteric, splenic, and inferior mesenteric to open into a common trunk, which may lie behind the pancreas or behind the upper or descending part of the duodenum, and then come to occupy the lesser omentum, slightly posterior to the common bile duct which is on the right and the hepatic artery which is on the left. In its course to the liver it receives the gastric, the cystic and the biliary tributaries. If the gastric vein does not empty into the portal but into the superior mesenteric, in case of portal occlusion, there is practically no chance for direct circulation except through the hepatopetal veins of Pick. At the portal fissure, the vein divides the right branch, broad and short, going to the right, the quadrate, and part of the caudate lobes of the liver. The left branch, longer and thinner, discharges into the caudate and left lobes. The ease with which the portal vein may be exposed in the gastrohepatic omentum is dependent upon the degree of periportal inflammation and omentitis. Probably the easiest approach is to incise the anterior peritoneal leaflet of the lesser omentum and isolate the common duct, drawing it to the right by means of a tape, great care being taken not to injure the hepatoportal veins (Fig. 2). The portal vein lying on a deeper plane becomes apparent with a little further dissection. The hepatic artery lying to the left is rarely visualized.

Beer (3), in 1915, reported the first case of portal vein ligation in suppurative portal phlebitis. He planned to modify Gerster's original suggestion of incising the portal trunk, evacuating the thrombi by flushing through a catheter and then closing the vein, by "ligating the vein, and after cutting the vein above the ligature, to drain the hepatic end with a rubber tube run into the lumen of the stump, and at the same time perform a cholecystostomy to drain the biliary system." The condition of the patient, however, did not permit a drainage of the portal vein. This should be quite feasible and, according to Winternitz (30), without much danger of back bleeding because if the smaller interlobular branches of the portal are occluded, the anastomosis with the hepatic artery becomes ineffectual and there is a mechanical obstruction of circulation in this area. This is followed by infarct formation, and with

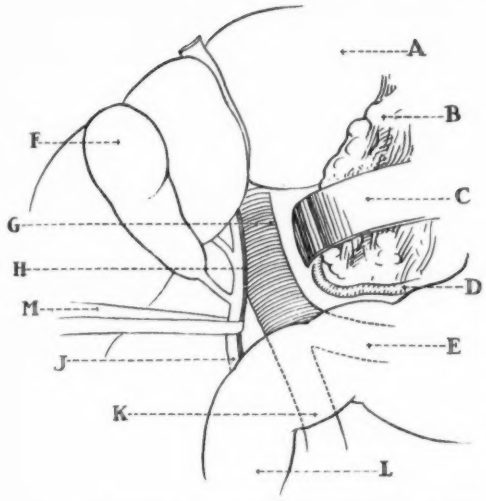

Fig. 2. Schematic representation of exposure of the portal vein in Case 3. *A*, Liver; *B*, gastrohepatic omentum; *C*, abdominal retractor; *D*, hepatic artery; *E*, splenic vein; *F*, gall bladder; *G*, portal vein; *H*, hepatopetal vein; *J*, common bile duct; *K*, superior mesenteric vein; *L*, duodenum; *M*, tape retracting common bile duct and hepatopetal vein to right.

infection present, abscess results. If, however, the hepatic end of the portal vein, when it is incised, should bleed too freely, it could always be ligated.

Herewith are appended the records of 4 cases of acute gangrenous appendicitis complicated by pylephlebitis. In 3, the portal vein, and in 1, the superior mesenteric vein (which, because of adhesions distorting it, was mistaken for the portal), was ligated with the hope of preventing spread of infection and preserving the integrity of the liver tissue. Unfortunately, all these cases ended fatally. Clinically, and at autopsy, these cases presented certain features which are of fundamental importance and justify their review. In Cases 1 and 4, the portal vein was ligated in one sitting. No change was noted in the patient's condition when the vein was first compressed for a variable length of time and none was observed after the ligature had been tied tightly. Case 1 survived about 48 hours. Case 2, in which the superior mesenteric vein was tied at its entrance to the portal, lived about 6 weeks. Case 4 died within 3 hours,

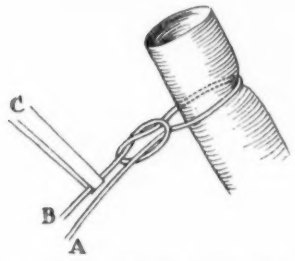

Fig. 3. Showing slipknot about portal vein.

but what part the portal ligation played is not known, for the patient was desperately ill when operated upon. In Case 3, which survived 8 days, the ligation was performed in two stages because at operation the vein was only slightly œdematous and it was thought safer to allow more time for collaterals to develop. This was done even though there were several dilated hepatopetal veins in the gastrohepatic omentum, one of such size that it had to be retracted to the right with tape, and in spite of the fact that digital compression of the portal vein did not produce any alteration in the pulse, respiration or general condition of the patient. At the first operation, a slipknot of Pagenstecher was passed about the isolated vein and its lumen was occluded to about three-quarters of its diameter by drawing the long string *A*, holding the knot steady by a clamp attached to the short end *B* (Fig. 3). Both the string *A* and the handle of the clamp *C* protruded from the wound after partial closure of the abdomen. After 36 hours the knot was tightened by drawing upward on the string and the clamp was removed. The patient survived more than 6 days after this, autopsy showing that the vein was completely ligated and that the Pagenstecher had not cut through the vessel wall.

Case 1.[1] H. G., shipping clerk, 25 years of age, married, was admitted February 20, 1915; died March 1, 1915. The father and mother were dead, 5 brothers and 2 sisters were all well. There was no tuberculosis nor cancer in the family.

The patient smoked 10 cigarettes a day and drank occasionally. He had had gonorrhœa 3 years previously, denied syphilis, pneumonia, scarlet fever, typhoid, etc. Two weeks ago he had grippe and sore

[1]Reported previously in Am. J. M. Sc. 1915, cl, 548.

throat. On the morning of February 17, he had experienced general abdominal cramps associated with vomiting, constipation, chills, and fever. The general pains subsided and became localized in the right iliac region, while thirst, frequency of urination, and prostration from lack of sleep persisted. The general condition was good, and patient was well nourished. The eyes reacted to light and accommodation. There were no palsies; no petechiæ. The tongue was coated, teeth were in good condition, pharynx was congested, tonsils were negative, as were ears, mastoid and thyroid. Glands were negative. The chest expansion was fair and equal; lungs, anterior and posterior, were negative; no dulness, no râles. The heart sounds were booming at the apex, with slight roughness of the first sound. The pulse was equal, regular, and of good force with tension not increased but rapid.

The abdomen was symmetrical and tympanitic, with tenderness, rigidity, and spasm of the right rectus muscle in the iliac region. The rebound sign was positive. The spleen, kidney, and liver were not palpable. The rectum showed tenderness and a sense of resistance in the right iliac fossa.

February 20, appendicectomy was performed for acute gangrenous appendicitis, through a right rectus muscle splitting incision, nitrous oxide and ether being used.

The appendix was found to be entirely gangrenous with fibrinous exudate on tip. There was no evidence of thrombosis in the mesenteriolum. The stump was carbolized, and the abdominal wound closed in layers.

The last inch of the specimen was somewhat bulbous; it was gangrenous, and contained foul smelling pus.

February 21. The patient appeared very septic and had two chills, with temperature 99.8 to 105; pulse, 106 to 132. Blood culture showed streptococci. He had severe pains in the right abdomen, and jaundice.

February 23: Leucocytes, 18,000; polynuclears, 94 per cent; lymphocytes, 6 per cent. Since operation the patient had had chills daily and septic temperature. The conjunctiva was deeply icteric. He complained of pain in the right hypochondrium, where there was distinct tenderness over the liver which is distinctly enlarged. The wound was clean.

February 24. Jaundice was more marked. Chills and high temperature persisted. Tenderness over the liver was more marked.

Diagnosis: Suppurative portal phlebitis.

Second operation, February 24. We intended to anastomose the inferior mesenteric vein and spermatic (left), and do an omentopexy so as to establish collateral circulation preliminary to ligation of the portal vein for pylephlebitis. Nitrous oxide and ether were administered.

An incision was made along the crest of the ilium to the left of the left rectus muscle. The lower pole of the kidney and the ureter were exposed, and the spermatic vein and main branch of the inferior mesenteric vein isolated. Attempt at making anastomosis was unsuccessful, because of the very small caliber and thin wall of the inferior mesenteric branch. The peritoneum was then opened for an omentopexy and the portal fissure palpated. A fair sized indurated area and enlarged glands were palpable at the portal fissure. The omentum was brought down and sutured to the parietal peritoneum with plain catgut suture, the peritoneum repaired as usual, and the wound closed in layers.

No ascites were present. The vessels in the omentum and the branches of the inferior mesenteric vein showed little abnormal congestion.

February 24 to 27. The patient seemed to remain about the same. The temperature was lower and he had only one chill.

Third operation. On February 27, ligation of the portal vein was done for suppurative phlebitis, with cholecystostomy for drainage of the bile tract.

A 4 to 5 inch incision was made in the right rectus from the ribs to the level of the umbilicus. A small amount of bile-stained fluid was found in the peritoneal cavity, with marked venous congestion of the stomach and gastrohepatic ligament. As the foramen of Winslow was shut off, and as the distended gall bladder prevented an easy approach to the region of the portal vein from the right side, the peritoneum over the vein was opened just above the duodenum over what appeared to be the site of the portal vein. Numerous glands of deep red color blocked the approach, and dissection along the tract of the hepatic artery caused very disagreeable bleeding. The bleeding was controlled and a cholecystostomy performed. Then another attempt was made to reach the vein after the choledochus was exposed for 2 inches. This approach was not blocked by glands and exudate, and the large blue vein was found mesial to the duct on a slightly deeper plane. It was impossible to state that there was a thrombus within, though the walls seemed thicker than normal. A ligature was thrown about the vein and when it was pulled sufficiently tight to occlude the lumen, no change in the patient's pulse was detected. Thereupon the vein was tied with heavy catgut. A rubber dam was placed along the ligature coming out along the gall-bladder tube and the wound closed and dressed.

The patient was in a state of shock when returned to the ward at 5 p.m. Under heroic stimulation his condition improved.

February 27, 8:15 p.m. Condition fair. Pulse of fair tension, regular, and of rate of 140. Respiration regular and not rapid (34). 8:45 p.m. Condition unchanged. Tongue very dry, rough and brownish; fur on dorsum. 9:15 p.m. Salt solution not retained by bowel. Answered questions correctly. 9:45 p.m. Condition unchanged. Looked comfortable. Pulse and respiration unchanged. Mind perfectly clear. 10:45 p.m. Pulse 140, good quality. Beats practically same in force, but occasionally one of weaker quality was felt. Was sleeping. Now awake. Recognized surroundings and persons previously known to

him. Jaundice apparently (artificial light) somewhat less marked. Tongue very dry in center. Was taking fluids in 2 to 3 dram quantities without vomiting. Bile drainage 4 ounces. 11:20 p.m. General condition fair. Pulse 134, good quality, regular in rate and rhythm. Did not complain of any pain. Jaundice seemed decidedly diminished, particularly of conjunctivæ. Breathing was regular, slightly increased in rate.

February 28 and March 1. Enemata were effectual and flatus was expelled. Œdema was present in scrotum, lower abdominal wall (perhaps more on left side), penis, and suprapubic region. (Infection?) Retention of 40 ounces of urine was relieved by catheter. The lumbar wound was infected and fascial necrosis present. The sutures were removed, and the wound was opened widely and packed with iodoform gauze. Bile drainage amounted to 6 ounces.

Blood culture taken in the morning showed bacillus coli. In the afternoon the patient became gradually comatose, and died 48 hours after operation without having given any evidence of blood either in vomitus or in stool.

Urine report. February 21. Amber; acid; specific gravity 1028; albumin, heavy trace; sugar and bile negative. Microscopically: hyaline casts, epithelial cells, and a few leucocytes.

February 22. Bile, negative.

February 24. Bile in urine.

February 25. Bile in urine. Blood culture of 12 cubic centimeters showed streptococcus.

February 28. Bile in urine.

March 3. Blood culture: bacillus coli.

Diagnosis. Acute suppurative pylephlebitis secondary to acute gangrenous appendicitis. Ligature of portal vein. Streptococcæmia.

Incomplete autopsy. Icterus and rigor mortis were marked.

No petechiæ were present, and no ascites. The portal vein found tied off with catgut about 1.5 centimeters above the head of the pancreas. Distal from the ligature, the entire portal system was found to be filled with thick dark brown grumous purulent material consisting of pus mixed with some blood. In the portal vein near the bifurcation and in its left main branch, there were also flat purulent thrombi on the vessel wall. Proximal to the ligature, the splenic and inferior mesenteric vessels were patent. The superior mesenteric and its right colic branch were filled with yellowish white purulent material. In places there were also thrombi. The thrombosed vessels containing yellowish white pus led down to the region of the cæcum and ileocæcal junction. The vessels in the immediate neighborhood of the appendix site were empty and showed no suppurative process.

The gastro-intestinal tract appeared normal, showing no circulatory disturbance. The coronary veins along the upper half of the lesser curvature and the retroperitoneal veins behind the ascending colon were widely dilated. The liver was slightly enlarged. Its lower border reached down about one finger breadth below the free border of the ribs. On section the organ was found studded with numerous small yellowish foci consisting of collections of pus. In the immediate neighborhood of each of these areas was a radicle of the portal vein, filled with dark grayish brown purulent material. The intervening liver parenchyma showed merely cloudy swelling. The common bile duct was patent and contained some thin yellowish bile.

The gall bladder was fastened to the abdominal wall by a catgut suture. A hole in its fundus was also closed with a suture. The gall bladder contained a small amount of mucopurulent material slightly bile stained. The spleen was about one-half larger than normal.

Bacillus coli was isolated from pus from the liver.

Microscopic examination of liver showed the capsule normal in thickness. There was moderate passive congestion in the centers of the lobules. The liver cells in this region were somewhat smaller than normal and contained granules of brownish pigment. Throughout Glisson's capsule there were numerous and extensive round cell infiltrations having no relation to the bile ducts and the hepatic arteries. In some places there were large collections of pus cells and cellular detritus, in the midst of which masses of bacteria were frequently to be seen. Most of these abscesses appeared to extend from foci in Glisson's capsule. Many of the smaller radicles of the portal vein contained parietal blood-platelet thrombi, with lumina containing red blood cells and only rarely collections of pus cells. The larger radicles of the portal vein appeared for the most part completely destroyed by a suppurative process and in some places the abscesses extended from this by contiguity.

The capsule and trabeculæ of the spleen were normal in thickness. Sinuses in the pulp and the large venus sinuses were markedly dilated. The malpighian bodies were rather small, contained no germinal centers, and were surrounded by a zone of congestion.

Case 2. Peritonitis; acute gangrenous appendicitis, with pylephlebitis. M. M., male, 27 years of age, was admitted September 5, 1920, with headache and pain in the stomach of a week's duration. The family history was negative. He had gonorrhœa 3 years ago, treated for 3 months. He was very easily excited. During attacks of excitement he trembled from head to foot and had palpitation of the heart.

One week ago the patient awoke with severe cramp in the epigastric region followed shortly by repeated vomiting of yellow fluid. He took several enemas and toward evening the cramps were relieved but severe headache and fever (103?) developed. The following day the headache and fever subsided but the cramps returned. The patient had continued to have several attacks each day, the cramps alternating with fever and headache. Appetite was entirely gone, and the bowels were moved only by enemas and medicine given by the doctor.

The only positive findings at examination were rigidity of the whole right side of the abdomen and tenderness in the right lower quadrant. White blood cells, 17,000; polymorphonuclears, 82 per cent; eosinophiles, 1 per cent; lymphocytes, 16 per cent; mononuclears, 1 per cent; temperature, 103.4 degrees F.; pulse, 112. The urine showed a very faint trace of albumin.

Operation. Appendectomy and drainage were done for acute gangrenous appendicitis with abscess. Nitrous oxide and oxygen were used.. A 4 inch right rectus incision was made. No free pus nor fluid were found in the peritoneal cavity. When the cæcum was lifted up a large abscess cavity was entered which extended upward behind the ileocæcal junction retroperitoneally. It contained about 8 ounces of foul pus. The appendix was found totally gangrenous except at its base, perforated, with enterolith free in the abscess cavity. Only a small part of the appendix was intraperitoneal, the greater part extending upward behind the peritoneum and the ileocæcal junction a distance of 5 inches. A large collection of pus surrounded the appendix in this retroperitoneal space.

The abscess cavity was evacuated by the suction method, and the appendix removed by sharp and blunt dissection. The base was ligated and carbolized. Two medium sized packings and a rubber tube drained the retroperitoneal abscess cavity; one tube led to the pelvis, and a rubber tube surrounded the upper set of drains. The wound was closed in layers with pincettes to the skin. The anæsthesia was uneventful.

September 6. Culture from throat showed staphylococcus aureus.

September 9. Packing and pincettes were removed and the wound was opened widely. Fascial necrosis was present. The wound was irrigated with Dakin solution and Carrel dressing applied.

September 11. Blood: hæmoglobin, 95 per cent; red blood cells, 5,100,000. Smear showed no abnormalities.

September 14. A moderately profuse purulent discharge with foul odor and fascial necrosis were present. Wound was irrigated with boric acid, strapped, and dry dressing applied.

September 16. Onset of chills suggested pylephlebitis. White blood cells, 28,000; polymorphonuclears, 87 per cent; lymphocytes, 10 per cent; large mononuclears, 3 per cent.

September 17. Blood: white blood cells, 20,000; polymorphonuclears, 80 per cent; lymphocytes, 19 per cent; large mononuclears, 1 per cent. Central pallor of red blood cells with a few macrocytes was present.

September 19. The discharge was much less than hitherto, and general condition was unaltered. The wound was cleaned and dry dressing applied. He had three chills yesterday. Examination of the chest showed hyperresonance, diminished breathing, no râles, and fremitus over left base, especially anteriorly. The splenic dulness was past.

September 20. Rectal examination showed a rounded, slightly tender, bulging mass high up on the right side. Blood culture was sterile. Fluid from chest gave negative smear and sterile culture. X-ray examination of the chest showed a marked elevation of the right diaphragm situated at the level of the fourth costal cartilage anteriorly. The heart was displaced toward the left. The roentgen appearance strongly suggested a process below the diaphragm.

September 21. Fluoroscopic examination of the chest showed the right diaphragm only slightly elevated, moving very freely on respiration, although not as well as the left one. If a local collection of pus could be excluded, patient probably had a pylephlebitis.

September 22. A pyocyaneous infection with profuse purulent foul discharge was present. The tubes were removed and cleaned, and wound cleaned with peroxide and alcohol, the skin cleaned with benzine and ether. Vaseline was used on the skin for dermatitis, the tubes were replaced, and dry dressing applied.

September 23. Blood culture was negative.

September 24. The stool was white-yellow, formed, with no gross blood; guaiac, negative.

September 26. White blood cells, 14,200; polymorphonuclears, 80 per cent; lymphocytes, 20 per cent; hæmoglobin, 46 per cent. A citrate transfusion of 425 cubic centimeters was given, with no reaction at time of transfusion. The blood was Group I.

September 27. *Operation.* The portal vein was ligated and cholecystostomy was done for the pylephlebitis complicating the appendicitis. Nitrous oxide and ether were used.

Pathology. A slight amount of turbid fluid appeared between the loops of the small intestine. Liver was of normal appearance, subphrenic space free, with no suggestion of multiple abscesses on the surface of liver. Gall bladder was normal, foramen of Winslow open. No engorged vessels suggested the presence of a collateral circulation except those about the portal vein. The loops of the intestine were not distended, vessels not engorged. The common duct was normal in appearance. The connective tissue about the portal vein in the portion exposed was infiltrated and adherent to the vein (periphlebitis). There were several enlarged left lymph nodes embedded in this connective tissue. Upon palpation this infiltration about the vein was not very dense. Superficial to the vein were a number of engorged veins, one of which appeared to run parallel to the portal vein. The wall of the portal vein was whitish, thickened, and almost completely collapsed. After its ligation, the vessel filled only slightly (perhaps half filled) below the ligature.

Procedure. A 5 inch incision was made between the fibers of the right upper rectus with cross cut of muscle toward the median line at the upper angles of the incision. The field of operation was packed off. Exposure of the portal vein was difficult because of the depth. The gall-bladder position aided

somewhat in bringing it forward. Exposure was attained by drawing up the liver, pulling and holding down the stomach and first portion of duodenum, and inserting the finger in the foramen of Winslow, pushing forward the structures in front of the finger. Blunt dissection was made of the peritoneum and infiltrated connective tissue to expose and partly isolate the common duct. Troublesome bleeding occurred from the engorged veins about the common duct and portal vein. These were caught and ligated. The hepatic artery was not seen. Identification of the portal vein was made only after some difficulty, the infiltrated connective tissue being at first mistaken for the vein. The portal vein was finally exposed completely, a ligature was passed about it (3 chromic) at the upper border of the foramen of Winslow. While superficial vessels were being clamped off and a cholecystostomy being done, the ligature about the portal vein was slowly drawn upon to occlude it. Finally, after some 20 minutes, the vein was closed off between fingers. No change was noted in the condition, pulse rate, etc. Cholecystostomy was done by two-tier suture, and the mucosa was inverted about the tube. A ligature about the vein was tied tightly as high up as possible (opposite the upper border of the foramen of Winslow, or higher). The abdominal incision was closed with through and through silk sutures, and the cholecystostomy tube drawn out at upper angle. Specimen of ascitic fluid and bile showed negative smear and culture. Jar tenderness of the right costal margin was noted, also scleral icterus. A rectal mass presented exudate with soft spot in center.

September 28. Bile, quantity 117 cubic centimeters, showed cholesterin 0.0218 per cent. The bile pigment content of gall bladder drainage was 270 milligrams per 100 cubic centimeters.

September 29. Bile, quantity 132 cubic centimeters, showed cholesterin 0.0148 per cent. The old appendiceal wound had a slight, very foul discharge. Pyocyaneous infection was still present. General condition was good. Patient had had no chills for two days. There was a trace of blood in the stool. The bile pigment content of the gall-bladder drainage was 250 milligrams per 100 cubic centimeters.

September 30. Blood chemistry: urea nitrogen q.n.s. milligrams per 100 cubic centimeters. Incoagulable nitrogen, 30.0; uric acid, 1.8; creatinin, 1.3. Bile, quantity 132 cubic centimeters, showed cholesterin 0.0148 per cent. Blood culture was negative. Drainage, quantity 31 cubic centimeters, showed cholesterin 0.010 per cent. The bile pigment content of gall-bladder drainage was 260 milligrams per 100 cubic centimeters.

October 1. Blood chemistry: urea nitrogen, 16.8; incoagulable nitrogen, 30.9; uric acid, 1.7; creatinin, 1.0; cholesterin, 0.21690. The bile pigment content of gall-bladder drainage was 90 milligrams per 100 cubic centimeters. The bile showed cholesterin, 0.0144 per cent. There was very little jar tenderness over the right costal margin, slight icteric tint to sclera. The bowels moved with enema, were colored, had bad odor, with no blood. He had not had chill since operation; neither had there been any abdominal distention or vomiting.

October 2. No blood appeared in the stool. Bile, quantity 20 cubic centimeters, showed cholesterin 0.0148 per cent. The bile pigment content of gall-bladder drainage was 120 milligrams per 100 cubic centimeters. Blood chemistry: urea nitrogen, 16.8; incoagulable nitrogen, 44.5; uric acid, 2.0; creatinin, 1.1. Hæmoglobin, 48 per cent; red blood cells, 2,640,000; white blood cells, 15,600; polymorphonuclears, 84 per cent; lymphocytes, 13 per cent; myeloblasts, 3 per cent. Smear showed central pallor marked. Moderate anisocytosis and poikilocytosis.

October 3. A citrate transfusion of 500 cubic centimeters was followed by a chill. Dry dressing was applied to wound. Bile, quantity 8 cubic centimeters, showed cholesterin 0.0125 per cent.

October 4. Bile, quantity 91 cubic centimeters, cholesterin 0.016 per cent. The bile pigment content of the gall-bladder drainage was 200 milligrams per 100 cubic centimeters. There was slight engorgement of the superficial veins; no abdominal distention; spleen not palpable. X-ray examination of the chest showed the diaphragm on both sides to be somewhat higher than normal. It was, however, normal in contour.

October 5. Blood chemistry: urea nitrogen, 21.0 milligrams per 100 cubic centimeters; incoagulable nitrogen, 43.1; uric acid, 1.8. Bile, quantity 55 cubic centimeters, cholesterin 0.0248 per cent.

October 6. Blood culture was sterile. The temperature was still high. On the previous day fluctuation had been, 11 degrees—95 to 106. There was considerable distention of the epigastrium, in fact of the whole upper abdomen. This region was tympanitic, with no nausea or vomiting. Infection appeared around through-and-through sutures. This a.m. for the first time, when the appendix wound was dressed, there was considerable venous oozing through the sinus requiring packing to control. Per rectum the mass (pelvic abscess?) appeared larger and there was a soft area in the center. General condition was fair. There was no occult blood in the stool. Hæmoglobin was 45 per cent; red blood cells, 2,200,000; white blood cells, 17,400; polymorphonuclears, 88 per cent; lymphocytes, 10 per cent; myeloblasts, 1 per cent; basophiles. Smear showed central pallor; no nucleated red blood cells.

October 7. Blood; coagulation time, 8 minutes. Yellowish tint to scleræ.

October 8. There was a profuse biliary discharge from the wound after drainage had already ceased for a few days; also considerable oozing from wound. Flatness of right chest could be noted posteriorly, with musical râles in left chest, but no evidence of pulmonary œdema. Condition of the rectal mass remained the same. Urine, 24 hour specimen, quantity 1,560 cubic centimeters, showed: total

nitrogen, 16.50479; ammonia, 1.4149; urea, 11.794. About 2 ounces of thick yellow pus was aspirated from the pelvic abscess. Smear showed many spermatozoa and polymorphonuclears. Culture gave bacillus proteus and anaerobic streptococcus.

October 9. Coagulation time was 14 minutes; 34 cubic centimeters of sodium citrate 30 per cent, was given at 2 p.m. Considerable amount of biliary discharge through wound with oozing from both wounds occurred. The patient was delirious at times and cyanotic with increased respiration. Marked dulness was noted over the right side of chest, and diminished breathing and râles. Upon aspiration of chest and subphrenic region (right side), blood was obtained. Chemical and microscopical examination of the 28 cubic centimeters (bloody) of material from rectal drainage showed cholesterin, 0.010, and occasional clumps of white blood cells.

October 10. In the left lung posteriorly were scattered moist râles which in the interscapular region in one place were constant in character. At this place the breathing and voice are bronchial in character. In the right lower lobe was diminished breathing, small moist râles and the note over the entire lung was dull. In the right axilla were friction rubs and small moist râles. At consultation, examination of the right axilla, restricted by the patient's condition, metastatic foci were noted in the left lung and probably in the right. The source of these metastatic foci is usually a parietal thrombophlebitis of the hepatic vein. The right lower lobe was partially atelectatic. The patient was delirious most of the day and night, requiring large doses of morphine and hyoscine to keep him under control. Fluid from the wound on smear showed many red blood cells, an occasional white blood cell, no bacteria.

October 12. There was fascial necrosis of the upper wound with profuse biliary discharge, but no oozing from upper or lower wound. General condition was somewhat improved.

October 13. Roentgen examination of the chest showed the right diaphragm still abnormally high in position. There was in addition an infiltration involving the greater portion of the left lung which was probably due to a pneumonia.

October 14. Increasing icterus was noted. Urine, 2 specimens, 100 grams of levulose given as liver function test. Urine for the next 6 hours failed to show reducing bodies. (Normal reaction.)

October 17 and 18. Occult blood appeared in stool.

October 19. Liver tenderness was almost entirely gone. The 24-hour specimen of urine, quantity 810 cubic centimeters, showed total nitrogen, 5.8741 grams; total urea, 7.6788 grams; total ammonia nitrogen, 1.1656 grams.

October 20. The 24-hour specimen of urine, quantity 1,440 cubic centimeters, showed total nitrogen, 10.4384 grams; total urea, 10.5408; total ammonia nitrogen, 2.7821.

October 21. The 24-hour specimen of urine, quantity 810 cubic centimeters, showed total nitrogen, 5.5323; total urea, 6.561; total ammonia nitrogen, 1.2336. Upon rectal examination a sinus was found leading into the rectal abscess which was closing down.

October 22. The 24-hour specimen of urine, quantity 960 cubic centimeters, showed total nitrogen, 8.064; total urea, 10.8288; total ammonia nitrogen, 1.2038. A citrate transfusion of 450 cubic centimeters gave no reaction.

October 23. The occult blood test was positive. The rectal sinus was dilated, nitrous oxide and oxygen being used, and a profuse venous hæmorrhage resulted which required packing before it could be controlled. No pus was obtained. There was no evidence of thrombosed internal or external hæmorrhoids. The 24-hour specimen of urine, quantity 1,620 cubic centimeters, showed total nitrogen, 9.9792 grams; total urea, 12.3444; total ammonia nitrogen, 1.1976.

October 24. The 24-hour specimen of urine, quantity 1,890, nitrogen 9.9489; urea, 12.7008; ammonia nitrogen, 4.2128.

October 25. Thrombosis of portal vein. The 24-hour specimen of urine, quantity 1,140 cubic centimeters, showed total nitrogen, 6.6074 grams; urea, 9.2340; total ammonia nitrogen, 2.4257.

October 26. Blood culture was negative. Blood chemistry: urea nitrogen, 14.0 milligrams per 100 cubic centimeters; incoagulable nitrogen, 32.0; uric acid, 1.6; creatinin, 1.5; cholesterol, 0.072; bile present. The full blood count, 10 cubic centimeters, was negative. The 24-hour specimen of urine, quantity 1,140 cubic centimeters, showed total nitrogen, 7.8523; urea, 8.9604; ammonia nitrogen, 1.9152.

October 27. X-ray examination of the chest showed a marked elevation of the diaphragm on the right side. The cause of this was not evident. Infiltration was evident in both upper lobes with indistinct signs of a cavity in the upper portion of the left lung.

October 28. Hæmoglobin, 35 per cent; red blood cells, 1,920,000; white blood cells, 12,200; polymorphonuclears, 67 per cent; lymphocytes, 30 per cent; mononuclears, 3 per cent. No occult blood in stools. The 24-hour specimen of urine, quantity 1,680 cubic centimeters, showed total nitrogen, 6.4848 grams; ammonia nitrogen, 1.5648; urea, 9.576.

October 29. No occult blood appeared in the stools.

November 4. At 8 p.m. the chest was full of coarse and fine, musical, sibilant râles. The patient was quiet after bromides and chloral had been given.

November 5. He ceased to breathe.

Autopsy. The peritoneal cavity contains no excess of free fluid. In the ileocæcal region is a small abscess about the size of a marble which is completely walled off by adhesions between the cæcum and ileum. The mesenteric vessels leading

from this region are apparently normal and entirely free of thrombus. On following the mesenteric veins upward they are found to be occluded at the point where they pass behind the pancreas, the site of the superior mesenteric vein at this point being occupied by an abscess the size of a plum. Just above the pancreas the superior mesenteric vein has been tied off by catgut. The splenic vein is distended and filled with fluid blood. There is apparently no obstruction to the flow of blood from the spleen into the portal vein. The portal vein and all its branches show a marked inflammatory thickening of the wall and contains a purulent clot. In this region at numerous places there are smaller and larger abscesses which have sprung from ramifications of the portal vein.

The liver is about 1½ times the normal size. On section it was found to contain abscesses. The parenchyma between these abscesses is rather brown in color and shows markings of passive congestion. One branch of the hepatic vein leading to the left portion of the right lobe is completely occluded by purulent thrombi.

The gall bladder and bile passages appear to be normal.

The spleen is about 20 centimeters in length. On section it presents the picture of a marked passive congestion, together with some swelling of the pulp. The kidneys and adrenals show no gross changes.

The stomach at two places on the posterior wall presents a small erosion about ½ centimeter square. The mesenteric lymph nodes are not enlarged.

Heart: Valvular orifices show no changes. Heart muscle is somewhat brown and of a glassy appearance. Aorta and coronaries: Present only slight evidence of atherosclerotic changes.

Lungs: Both lungs show abscesses in all lobes, two to three abscesses in each lobe varying in size from a pea to a walnut.

Pus from the hepatic vein showed staphylococcus aureus.

Microscopic examination of slides. Heart muscles are œdematous, striations of muscle fibers are gone. There is a moderate amount of bipolar pigmentation and perivascular fibrosis. The lung shows large areas of abscess formation with purulent pneumonia and hæmorrhage into the lung. The liver is œdematous. Scattered throughout the section are numerous large abscesses which are very well walled off by a fibrous wall. Many of the portal radicles contain pus cells. The kidney shows marked passive congestion and degenerative nephrosis. The epithelium of the convoluted tubules is markedly degenerated. The spleen shows marked passive congestion and hypoplasia of the malpighian corpuscles. Numerous polynuclear cells and swollen endothelial cells are present throughout the pulp.

Diagnosis: Suppurative pylephlebitis (appendectomy for acute gangrenous appendicitis with abscess). Suppurative phlebitis of hepatic vein. Multiple abscesses of lung. Retropancreatic abscess. Erosion of stomach.

CASE 3. A. A., female, Russian, 27 years of age, married, 2 children, came complaining of abdominal pain of 3 days' duration. The diagnosis was acute appendicitis with abscess.

May 5, 1925. About 3 days previously abdominal pains occurred, gradual in onset, located in epigastrium for 2 days, gradually radiated to right lower quadrant where they remained for 24 hours, sharp and constant, relieved by cold applications, with no relation to meals, getting more severe. Associated with the abdominal pain was anorexia, belching of gas, nausea, and vomiting. She had vomited several times every day, but no blood was in vomitus. Fever had been present for 24 hours. She had had 2 chills the day before admission. The bowels moved 24 hours ago with enema. She took several doses of castor oil 3 days ago and 2 days ago, with resulting bowel movements. No blood appeared in stools. She had coughed slightly for the past few hours. No jaundice, urinary or menstrual disturbances were noted except dysmenorrhœa with each period and pains in the hypogastrium. The last period was 3 weeks ago.

The patient had had 2 similar attacks, 8 and 5 months ago, each lasting about 2 days, with severe epigastric pains (no radiation), nausea, vomiting. Between attacks, she had had belching of gas, sour eructations, occasional epigastric pain and nausea. The genito-urinary, cardiac, respiratory, muscle, neurological, and eye, ear, nose, and throat examinations were negative.

She had had no former illness nor operations. The family history was negative.

The patient was an obese, middle-aged woman, lying quietly in bed, appearing acutely ill, dehydrated, cyanosed, with temperature 102.4, pulse 112, respiration 24 The pupils were regular and reacted to light. Ears and nose were negative externally. The lips were cyanosed, dry; tongue was white coated, dry; many teeth were filled; tonsils were injected. The percussion note was resonant, breath sounds distant, many sonorous and sibilant râles throughout. There was no enlargement of the heart, sounds were irregular, poor in quality with systolic murmur at apex, percussion note accentuated and reduplicated.

Abdomen. Superficial tenderness in right lower quadrant, deep tenderness in right upper quadrant, right lower, and left lower, more marked in right lower; rebound tenderness in right upper and right lower quadrant; rigidity in right upper and right lower quadrant; no masses. Rectal tenderness extended high up on right side. The pelvis was not examined. The skin, bones and joints, and extremities were negative, the knee jerks were 2+ and equal. A provisional diagnosis of acute appendicitis with local peritonitis was made.

Operation, May 5, 1925. Appendectomy and drainage were done for acute gangrenous appendicitis with peritonitis, nitrous oxide, and ether being used. A moderate amount of thin cloudy fluid appeared in the right lower quadrant. The

peritoneum was dull red, with little fibrin. The appendix was subcæcal in position and thickened and was œdematous, very friable, and gangrenous at the base. The cæcum was thickened, œdematous, and friable.

The Kammerer incision was used, free fluid was aspirated, the appendix mobilized and removed in the usual fashion, ligated with No. 3 chromic catgut, the stump carbolized and sewed with No. 0 chromic purse-string suture. A single large rubber tube drained the site of the appendix. The wound was closed in layers. Silk was used for the skin.

A smear of the peritoneal fluid showed gram bacilli; culture, bacillus coli communis. The specimen of the appendix showed acute diffuse inflammation.

May 6. Temperature, up to 104.6. Chill, slight cough, no pain in chest, somewhat exaggerated breathing with few moist râles at left base, no definite dulness nor bronchial breathing. The abdomen was soft, not tender. There was no vomiting. Sibilant and sonorous ronchi were noted at both bases posteriorly with dulness and bronchovesicular breathing at right base. It was the impression that bronchitis with bronchopneumonia had set in.

May 7. The abdomen remained soft, not tender; there was no vomiting. A moderate amount of thick, gangrenous, purulent discharge came from the tube; the wound edges were slightly reddened and indurated. Rectal examination was negative. Chills and fever continued, with no evident jaundice (temperature swinging in character). The impression was that pylephlebitis was developing. X-ray examination of the chest did not show any definite abnormality of the lungs.

May 8. The general condition was fair, no chill since 10 a.m. previous day. A fair amount of discharge and some fascial slough were noted. The abdomen was soft and not unduly distended. There was no liver tenderness; no jaundice. Lungs showed a generalized bronchitis.

May 9. The presence of a moderate amount of dark, brown, very foul (questionably fascial or fæcal) discharge led to opening of lower retention suture and wound; no massive infection disclosed. The medical consultant found signs of chronic bronchitis, that is, sibilant, sonorous breathing and moist râles; heart presented none of the physical signs of mitral stenosis; the accentuated P_2 sound was probably associated with the chronic bronchitis; on deep percussion over the lower right axilla, that is, over the subphrenic and hepatic area, acute tenderness was elicited; examination of the chest did not reveal any lesion which would account for the chills and fever. Specimen of blood bilirubin: direct-delayed trace present; indirect: 1 to 60,000; 1.75 milligrams per 100 cubic centimeters of serum.

May 10. Patient was beginning to appear septic. Temperature was of the steeple type, chills having again appeared after a free interval of 24 hours. The abdomen was slightly distended but soft and lax throughout. A fæcal discharge, very moderate in amount, unquestionably came from a localized fascial slough, because when the wound was opened further by removal of sutures, the underlying tissues appeared fairly normal. The rectal examination was negative. No jaundice was apparent; there was some tenderness in the eighth right interspace, clavicular line and some tenderness in the costal arch (right) upon pressure. There was no costovertebral tenderness. There seemed to be sufficient evidence that there was a pylephlebitis and the question arose whether a gradual ligation of the portal vein might not be in order. The hæmoglobin was 74 per cent; red blood cells, 3,800,000; white blood cells, 11,600; polymorphonuclear neutrophiles, 81 per cent; eosinophiles, 2 per cent; lymphocytes, 16 per cent; mononuclears, 1 per cent. The smear was normal.

Blood culture was negative. Bilirubin—direct: delayed trace; indirect, 1 to 50,000; 2 milligrams per 100 cubic centimeters. Blood culture from portal vein was sterile. Pre-operative culture was sterile.

Operation. A diagnosis of pylephlebitis was made. Partial occlusion of the portal vein, through a right Sprengel incision, was made, nitrous oxide and ether being used. When the peritoneal cavity was opened there was a gush of about 1 ounce of blood-stained fluid. The liver appeared normal and was not enlarged. The gall bladder was distended and there were some fibrinous adhesions matting the structures of the upper abdomen together. The foramen of Winslow was patent. Structures of the gastrohepatic omentum were normal in distribution. The portal vein appeared normal in size and was not particularly œdematous. There was some enlargement of the glands along the superior border of the pancreas and the lower border of the gastrohepatic omentum.

The gastrohepatic omentum was packed off. The hepatic artery and common bile duct were retracted to the right by means of a tape. The portal vein was isolated and partially occluded by a No. 4 Pagenstecher ligature passed in the manner illustrated. This was surrounded by a piece of rubber dam. The portal vein was aspirated and blood sent for blood culture. While the portal vein was being ligated partially, there was no change observed in the patient's general condition, pulse or respiration.

Unfortunately the gall bladder was not aspirated.

The peritoneum and transversalis fascia were closed with continuous chromic sutures, and the fascia closed with interrupted chromic; with silk for the skin. The hepatic artery was aspirated at operation, and the vein was occluded ¾ of its lumen.

May 11. At 1 a.m. Unfortunately the gall bladder was not distended at the time of operation and inasmuch as it was distended, and the portal vein itself did not show much evidence of inflammation to rule out an empyema of the gall bladder, an exploration was deemed advisable. Accordingly, under nitrous oxide and oxygen anæsthesia, the

outer half of the original incision was opened, and the gall bladder aspirated. The bile was not purulent, it looked almost normal. A cholecystostomy was done, purse string of chromic being used. The gall bladder was sutured to the abdominal parietes with interrupted chromic catgut. A rubber tube was used for drainage, and the wound closed in layers. The condition at the expiration of operation was good. The bile was golden brown in color, and thin. It showed bilirubin, 270 milligrams per 100 cubic centimeters, and urobilinogen and urobilin negative. The blood chemistry was: urea nitrogen, 22.4; incoagulable nitrogen, 40; creatinin, 1.0; sugar, .122; cholesterin .190; uric acid, 2.5.

At 9 a.m. The general condition was no worse; temperature, 104; pulse, 120, fairly full; tongue slightly dry; abdomen soft and lax. Biliary drainage about 2 ounces. The appendix tube was removed and one of soft character and narrow caliber introduced.

At 11 p.m. The general condition was about the same, temperature 102, pulse 118. The tongue was slightly more moist. The portal ligature was tied tight and the clamp removed; the long end of the suture was still in place. No chill had occurred since the operation. Biliary drainage, 2 ounces.

May 12. It was difficult to ascertain the exact indications in regard to the dietetic treatment because of lack of blood sugar determinations. It was important to control in this case with blood sugars at least twice a day.

At 3 p.m. It was now 48 hours since the ligation of the portal vein, and since that time there had been no chills and the temperature was 101, with a pulse of 100. The patient was slightly better. There had been no nausea or vomiting and the fluids which had been forced had been well tolerated. Bowels were moving with enemata. The abdomen was soft and lax throughout.

Dressing of the appendix wound disclosed moderate gray, foul discharge with odor of fascial necrosis. A tract of fascial necrosis extended for 8 to 10 centimeters under the closed skin wound; the peritoneal sutures were intact. The lower portion of the gaping skin wound was packed loosely with wet gauze after the entire tract had been irrigated with Dakin's solution. Wet dressing was applied. The total biliary drainage from 7 p.m. to 7 a.m. showed: bilirubin 100 milligrams per 100 cubic centimeters; urobilinogen and urobilin, small amounts.

May 13. At 9 a.m. Blood sugar, 0.170; 6 p.m., 0.145, 0.110 per cent. The general condition was a little less satisfactory than it had been the previous day at 7 p.m. A chill had lasted 20 minutes with rise of temperature from 99.3 to 104. The temperature at 8 a.m. was 101.2, pulse 100. Definite icterus was present. There had been no nausea nor vomiting, bowels moved twice spontaneously and stools contained bile. The appendiceal wound was still sloughing with a moderate amount of foul discharge. The biliary discharge was scant. The whites of 3 eggs (coddled or soft boiled) with purees or thick soups were added to diet. Biliary drainage: trace of urobilin, urobilinogen, bilirubin: 22 milligrams per 100 cubic centimeters.

May 14. Biliary drainage, sterile specimen, 7 a.m. to 7 p.m., trace of urobilin, urobilinogen, bilirubin: 22 milligrams per 100 cubic centimeters.

May 15. The condition at times suggested cholæmia; at other times she seemed fairly well. She was now more jaundiced and the chills had been recurring with regularity about every 12 hours. There had been no nausea nor vomiting and the bowels had moved regularly. Fluids were well taken; the amount of urinary output could not be measured because of incontinence. Up to the present time, cultures from the portal vein and the median basilic vein had been negative. There was no blood in the stools; guaiac, negative. The appendix wound was irrigated; a moderate, thick, foul discharge was noted; fascial necrosis was present; the tube was shortened. The wound in the right upper quadrant showed firm union, no induration or redness of the margins, apparent primary union except at point of cholecystostomy tube exit. Blood chemistry: urea nitrogen, 30.8; incoagulable nitrogen, 53.8; uric acid, 2.5; creatinin, 1.3; cholesterin, 0.072 per cent; blood sugar, 0.072 per cent. Biliary drainage, 7 a.m. to 7 p.m., showed a trace of urobilin, urobilinogen, bilirubin: 3 milligrams per 100 cubic centimeters.

May 16. The patient was definitely more icteric. There were numerous small pinhead size papules over the right arm and some periorally. A single specimen of urine showed urobilinogen and bilirubin in considerable quantity. Drainage showed a trace of urobilin, urobilinogen, and bilirubin; 1 milligram per 100 cubic centimeters.

Van den Bergh: direct positive 4+, indirect, 1.12000, 8 milligrams bilirubin per 100 cubic centimeters.

May 17. 8 a.m. Bright red blood suddenly appeared on the dressings of the wound overlying the portal vein. Bright red liquid blood oozed continuously along the dam, pressure increasing the flow. The ligature was intact. The impression was that the portal vein was lacerated. Patient was not dyspnœic. Pulse had not changed in rate or quality. She appeared pallid despite icterus. Loss of blood was estimated at ±300 cubic centimeters.

9:15 a.m. There was definite bleeding along the dam in the upper transverse wound and some blood through the cholecystostomy tube. The wound was opened for 2 inches and bleeding definitely established as coming from depths. Packing was introduced above the dam into the region of the gastrohepatic omentum and wound packed with gauze. A sandbag was placed across the upper abdomen; 100 cubic centimeters of saline with 10 cubic centimeters of a 10 per cent calcium chloride solution was given intravenously and patient was grouped for transfusion. The van den Bergh reac-

tion was direct positive 4+, indirect 1.11000, 9 milligrams bilirubin per 100 cubic centimeters. At the conclusion of the packing the patient was pallid and definitely shocked with a pulse of 120. For 48 hours there had been no chill and the temperature had ranged from 102 to 101.

1 p.m. The condition was very poor; pulse rapid and thready; patient comatose, respiration slow and longer, no external evidence of continued bleeding. A solution of 100 cubic centimeters of a 1 per cent solution of calcium chloride was given intravenously, and continuous intravenous saline was started. The hæmoglobin was 43 per cent. A citrate transfusion of 550 cubic centimeters of blood was given.

May 18. The patient was moribund, pulse thready with rate of about 120; she was vomiting tarry material. Blood was discharging through tube and still oozing through dressing. The blood van den Bergh: direct positive 4+; indirect 1.9000, 3 milligrams bilirubin per 100 cubic centimeters. *Final note.* This was a case of acute appendicitis with abscess complicated by a suppurative pylephlebitis. In order to check the extension of the pylephlebitis into the liver, an attempt was made to tie off the portal vein. However, fever and chills continued even after the second operation. The condition gradually became worse, the jaundice became increasingly severe, and the patient died 2 weeks after admission.

May 19. The van den Bergh: direct positive 2+; indirect 1.33000.

Autopsy. Body is that of a well developed and nourished woman about 30 years of age. There is an icteric tinge to the skin. No petechiæ. In the right lower quadrant is a partially healed operative incision about 10 centimeters in length and in the right upper quadrant a more recent one situated obliquely and almost parallel with the free costal margin about 5 centimeters below the latter. This second incision is about 15 centimeters in length. Its edges are greenish and brown but there is no suppuration or marked thickening in the wall of the wound. When the abdomen is opened by extension of the upper wound about 80 to 100 cubic centimeters of clotted fluid and blood are encountered. The clots extend down to the region of the porta-hepatica. When the upper transverse incision and the lower vertical one are joined and the fibrinous adhesions between the loops of bowel and the parietal peritoneum are separated, there is a gush of turbid yellowish, foul-smelling fluid. The latter is loculated off in several places but is most abundant in the pelvis and cul-de-sac; in all it measured about 400 cubic centimeters. The peritoneum in the region of the cæcum is chronically and acutely inflamed, both on the visceral and parietal surfaces. On the portal vein on the under surface of the liver is a ligature. The liver is moderately dilated both above and below the ligature. The bile ducts lying anterior to it are apparently patent, but there is some pressure upon them by surrounding œdematous tissue. The gall bladder has an incision and suture at its free upper end, and contains no bile. The hepatic artery lying somewhat anterior to the portal vein is grossly negative. When the portal vein is opened an occluding white and red thrombus is found in the distal portion of the ligature, and proximal to hepatic portion is broken down grayish-black, thick, purulent material. From this point practically to Glisson's capsule all the branches are filled with the same grayish purulent material. The veins are considerably dilated; and adherent to the intima are irregular patches of yellowish, fibrinopurulent material. In several areas the veins seem to open directly into abscess cavities which riddle the liver throughout. The largest of these cavities is about 4 centimeters in diameter, the smallest visible ones are pinhead in size. In several places the abscess cavity is honeycombed and contains strands of partially broken down liver tissue. The liver weighs 1480 grams. Where there are no abscesses the liver parenchyma is grossly negative, and of the usual brownish-red color. The hepatic veins are negative. The portal vein on being traced down shows no other thrombi except the one which extends for about 3 centimeters below the ligature.

Even in the ileocæcal region where the vein lies almost in the center of an abscess there is no gross evidence of phlebitis. The branches coming from the spleen, mesentery, and pancreatic regions are grossly negative. There is no evidence of any collateral circulation or any stasis in the vessels leading into the portal vein.

Gastro-intestinal tract: The œsophagus and stomach contain considerable amounts of black fluid and bloody material. The mucosa is negative. The small intestines from the duodenum to the ileocæcal junction show no abnormality. The longer portion of the cæcum is somewhat distorted by retrocæcal small masses and by adhesions to the parietal peritoneum and lower part of the ileum. The mass behind the cæcum consists of an "L" shaped abscess cavity, the longer portion of it being about 4 centimeters in length and the smaller portion about 3 centimeters in length and 2 centimeters in width. There is a vein passing through the smaller of these two cavities but at no point can any phlebitis or perforation into it be found. The appendix is absent. The remainder of the large intestine is negative.

The spleen is large and flabby and weighs 220 grams. The capsule is thinly covered with purulent exudate. On section, the splenic parenchyma is dark red in color, soft, and friable. The malpighian corpuscles are barely visible. Splenic vessels are negative.

The adrenals and pancreas are negative.

Together the kidneys weigh 340 grams. They are practically normal in size, shape, and position. The capsules strip with ease revealing smooth surface. Cut section of the organ is yellowish in color. The markings are well preserved. There is normal

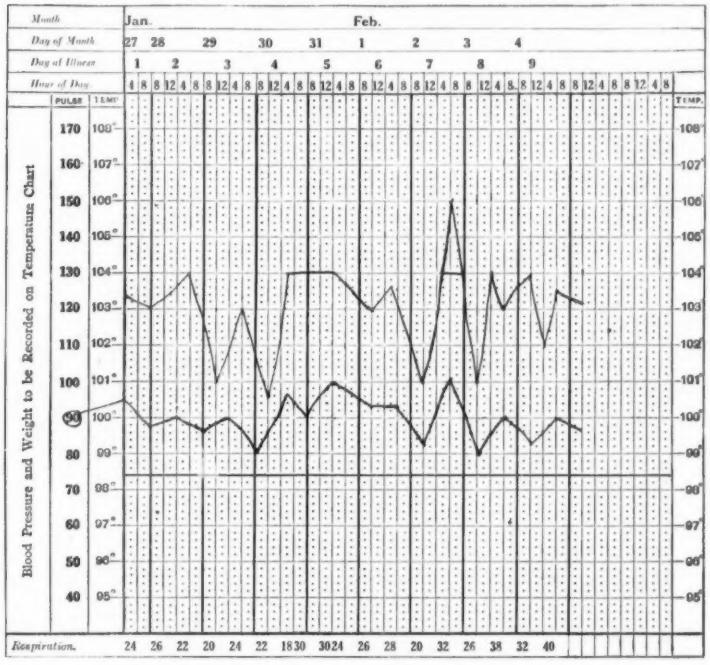

Fig. 4. Chart showing pulse, temperature, and respiration in Case 4.

relationship between cortex and medulla. The pelves and ureters are negative. The bladder mucosa is the seat of a hæmorrhagic and cystic lesion which covers it throughout. The small vesicles composing this lesion, some of which are hæmorrhagic, are about 3 centimeters in thickness and apparently do not go beyond the mucosa. There is no apparent break in the continuity of the surface. The uterus is pear-shaped, practically normal in size, shape, and position. The endometrium is slightly thickened and at the opening of the right fallopian tube there is a slight submucosal hæmorrhage. The cervix is laterally lacerated on both sides. The tubes and ovaries are negative.

The chest is well developed, with no deformities. The lungs are moderately adherent throughout to the parietal pleura but these adhesions can be separated without tearing the lung. The lungs together weigh 880 grams. They are well aerated and salmon pink in color. There is no evidence of infiltration or congestion. There are several packets of intertracheal-bronchial lymph nodes varying in size from 3 to 4 centimeters in diameter. These are grayish black in color and homogeneous on section. The bronchi, trachea, and blood vessels are negative.

The heart weighs 440 grams. There are about 40 cubic centimeters of yellowish clear fluid in the pericardial sac. The myocardium is pale red in color. The heart is practically normal in size shape, and position. The endocardium and valves are negative. There is a small opening in the foramen ovale which is loosely covered over by a crescentic edged portion of the endocardium. The ductus arteriosus is closed. The coronary arteries are patent and of the usual distribution and origin. The aorta is elastic and has only very slight superficial atheromatous deposits.

Smears of pus contain a variety of Gram positive and Gram negative bacilli and cocci with a predominance of Gram negative bacilli. Culture gives bacillus coli communior.

Diagnosis: Suppurative pylephlebitis; multiple liver abscesses; retrocæcal abscesses (operation, appendectomy; ligation of portal vein); cystitis cystica.

Case 4. J. S., age 50, scaleman, male, was admitted to Belleview Hospital, January 27, 1921; died February 4. The diagnosis was acute appendicitis with pylephlebitis. On January 25, he first experienced the onset of pain in the stomach. The next day this pain became localized in the right lower quadrant, at first dull, later sharp, and non-radiating, relieved by bending over, increased by pressure. He took castor oil with good results. He had slight frequency of urination, no pain, no blood, no jaundice, no fever, no chills. The family history

was negative. His habits were good, and he had had the usual childhood diseases. Otherwise his history was negative.

Examination showed him to be acutely ill, temperature 103 degrees F., pulse 94, respiration 24. The scleræ were conspicuously jaundiced, pupils were normal; he had marked pyorrhœa. The rest of the head, the neck, chest, and heart were negative. The abdomen was flat, not distended, with tenderness and slight rigidity in the right lower quadrant. Hyperæsthesia was noted over McBurney's point. Rebound tenderness was present, with no tenderness in right upper quadrant. The extremities and rectum were negative. A provisional diagnosis of acute appendicitis was made.

January 27. Operation was performed under ether anæsthesia, through a right rectus incision. The appendix was gangrenous, perforated near its center, friable. Free fluid was found in the peritoneal cavity. The appendix was removed with cautery and drained. Recovery from the operation was fair on the first day.

January 28. Urine; dark amber; specific gravity 1.040; acid; trace albumin; no glucose; hyaline, granular casts.

January 29. Atelectatic râles were noted at both bases. The general condition was fair. He took fluids well. Tap water was given by rectum. Blood: Leucocytes, 15,000; 100 cells counted; polynuclears, 92; transitionals, 13; lymphocytes, 5. Culture of blood was negative after 48 hours; bile showed colon bacillus.

January 31. The scleræ were icteroid. The patient was having chills and sweats with sudden rises in temperature. A slight discharge appeared in the wound, with pain and tenderness in the right upper quadrant. Pylephlebitis?

February 1. The right posterior chest was flat between the medial and inferior angle of the scapula. The breath sounds were suppressed and bronchovesicular; voice was increased, fremitus diminished. The right anterior chest was dull from the fourth interspace downward. The subcutaneous tissues about the nipple were puffy and œdematous. The heart showed a soft systolic murmur at the apex. Physical signs pointed to a probable subphrenic abscess.

February 3. Patient had hiccough temperature of 104, and was irrational.

February 4. Operation for pylephlebitis was decided upon. Local and nitrous oxide oxygen anæsthesia was used and an oblique right upper rectus incision made. The viscera were found engorged with no evidence of abscess of the liver. The gall bladder was distended, preventing approach to the gastrohepatic ligament which was found thickened with exudate and enlarged glands. Over the cystic duct was a fibrinous exudate. The gall bladder was emptied and the tube inserted. A finger was invaginated into the foramen of Winslow and the ligature carried around the hepatic artery and the common duct for traction. With these structures out of the way and the finger in the foramen of Winslow, the portal vein was exposed and aspirated; fluid blood was obtained. A chromic gut ligature was tied about the vein above the point of puncture. The ligation of the portal vein caused no change in the patient's condition. The wound was closed in the usual manner. The aspirated fluid from the gall bladder was turbid bile. The walls of the gall bladder showed no evidence of inflammation. Urine; green amber in color; specific gravity, 1.036; acid; trace albumin; no glucose; hyaline and granular casts; bile 2 plus.

The patient reacted from the anæsthesia with a pulse of 100. The general condition became poor and he was dead 3 hours after the operation.

The primary cause of death from postmortem findings in Cases 1 and 3 was hepatic insufficiency, the result of diffuse suppuration; it could not be assigned to the direct effect of vein ligation because the patients lived several days following this procedure.

Two other important findings disclosed by the autopsies were the absence of ascites and the lack of engorgement and congestion of the veins of the abdominal viscera, proving, very likely, that adequate circulation must have been maintained through collateral channels even though the portal was occluded. This is of vital importance. It means that either a beginning thrombophlebitis of the portal vein has already opened up collaterals, or that the hepatopetal veins in some patients are sufficient "to carry on," even though the portal may be suddenly and completely occluded.

SUMMARY

1. The prognosis of pylephlebitis complicating acute appendicitis, while grave, is not absolutely hopeless. If the diagnosis is made before operation, the surgical procedure of choice is a ligation, or preferably a resection of the ileocolic vein, prior to the appendicectomy. If this complication occurs or is recognized after operation, surgical intervention is of little avail, unless indications point to a definite liver abscess when drainage is indicated.

2. The hepatopetal system in certain individuals can efficiently "carry on" portal circulation in the presence of a portal occlusion of pylephlebitic origin.

3. The ligation of the portal vein in cases of pylephlebitis in this series proved of no

value; because of the peculiar pathology of this condition, it is very doubtful whether it is ever indicated. And, should the process have already extended beyond the ileocolic ligature there is still no need for portal ligation, for patients occasionally recover if all of the primary thrombus has not been removed.

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PARASITIC FIBROMYOMATA[1]

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JULY 8, 1925, a true parasitic fibromyoma, 6.5 by 3 by 3 centimeters, was removed at the Mayo Clinic in the course of an operation for duodenal ulcer. In the clinic records only two similar cases can be found. There are, however, many with definite indication of interference with the blood supply from the uterus. In some cases the condition was inflammatory with œdema and recent vascular adhesions or commencing degeneration with cystic changes in the tumor; but in most cases the parasitic characteristics were evidently of slow development as indicated by the absence of changes in the tumor itself, in spite of the fact that it was receiving most of its blood supply through firm adhesions to other structures, especially the omentum and appendices epiploicæ of the sigmoid.

The literature contains very few cases of sequestrated, wandering, or parasitic fibromyomata, and most of those reported have been on record for many years. In 1858, West reported one case of a fibromyoma attached in the cul-de-sac of Douglas. In 1861, Turner reported one case of a fibromyoma attached at the posterior brim of the pelvis and to the omentum, and Williams mentioned cases reported by Croom, Baldy, Eve, DePaul, Wylie, Rindfleisch, Routh, Wallace, and others. He also described two specimens in the Hunterian Museum, London. Stone reported two cases and referred to others discovered by Edebohls, Knott, and Peterson (4). In 1905, Knott brought the subject up to date and reported two cases of his own. He mentioned several of the cases referred to by Roger Williams and also others quoted in personal communications from J. Whitridge Williams, Noble, and Martin.

There is no doubt that some cases have been observed in recent years and not yet recorded. The partially parasitic tumors are of frequent occurrence and are only of interest in indicating the preliminary steps in the development of the true parasitic tumors. I have operated on several patients with pedunculated uterine

[1]Read before the Western Surgical Association, Wichita, Kansas, December 18 and 19, 1925.

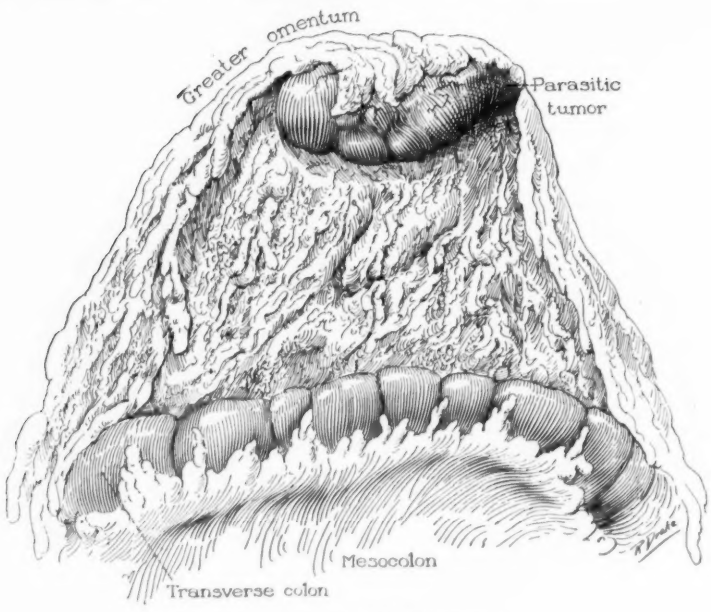

Fig. 1. True parasitic fibromyoma.

myomata with long, attenuated pedicles, and firm vascular attachments to the omentum and other structures which supplied most of the vascular connections necessary for their vitality; in some cases the connection with the uterus was merely represented by a double fold of peritoneum. Myomata of the vaginal wall are by no means rare, and without doubt, practically all of them arise from the smooth muscle of the vaginal wall. However, the possibility of a pedunculated submucous fibromyoma of the uterus becoming attached to the vaginal wall, as the result of pressure necrosis and later losing its uterine attachment has to be admitted, and is well illustrated by one of my cases (Case 6). If there is no contraindication to a major operation, all parasitic tumors should be removed, as they are prone to undergo inflammatory changes which will predispose to new adhesions and such complications as intestinal obstruction or interference with the function of some important organ. The possibility of malignant change also exists as one of the cases reported by Knott was that of a fibrosarcoma. Removal is a simple surgical procedure except in cases in which the tumor has become adherent low in the pelvis or to the mesentery of the intestine. In either case, the acquired vascular connection will consist of very short, large vessels communicating with the mesenteric system or branches of the internal iliac artery and vein. Great care is necessary in the removal of such tumors on account of the danger of interfering with the blood supply to a section of a bowel, or injury to a ureter.

Myomata may originate in any smooth muscle but most of them originate in the intermediate layer of the uterus, and over 90 per cent in the corpus or in that part of the uterus in which the changes incident to menstruation and pregnancy are most marked and where the muscular tissue is best developed. Just why they are more often found in the fundus and posterior wall is hard to explain.

As myomata increase in size, their location frequently changes. The soft, rapidly growing tumors are, as a rule, completely surrounded by muscular tissue, and when this is incised, they can be expressed with comparatively

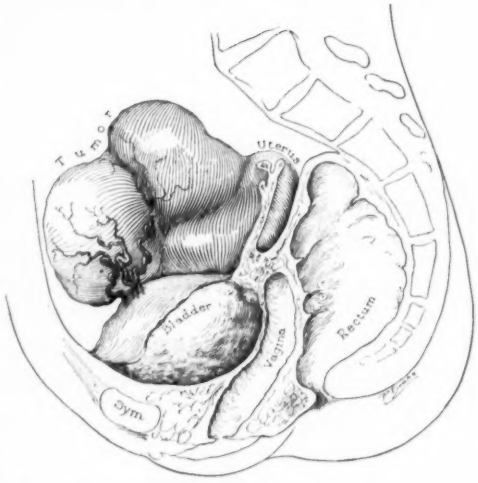

Fig. 2. Intraperitoneal, partially-parasitic fibromyoma.

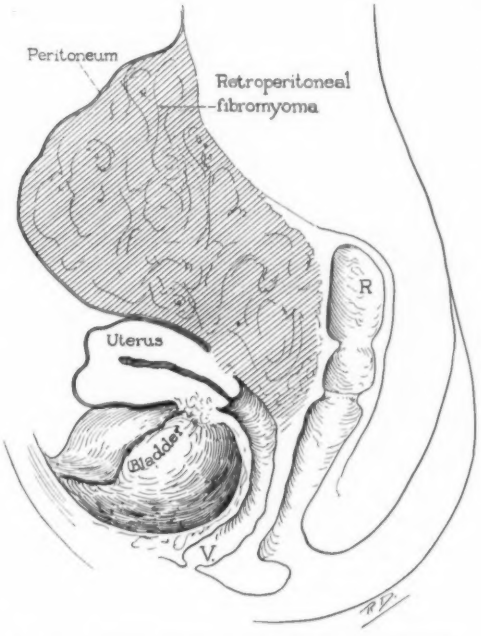

Fig. 3. Retroperitoneal, partially parasitic fibromyoma.

little bleeding and show no definite vascular attachment. As the tumor increases in size, it often forces its way through the muscular tissue and appears either on the serous or mucous surface, first as a sessile projection and later as a pedunculated myomatous mass. At the same time interference with its circulation increases, and there is a tendency for the tumor to become firmer as the result of an increase of fibrous tissue and decrease in the amount of muscle. It frequently happens that one tumor will develop directly beneath another, and as the later one grows, the more superficial one will be farther and farther removed from its original blood supply. In other cases, the tumor will be extruded from the uterine wall and will remain attached by a definite pedicle of either mucous membrane or peritoneum, through which a more or less impaired blood supply reaches the tumor. Such tumors are prone to undergo degeneration, and, if submucous, will either become adherent to the vaginal wall as the result of pressure necrosis or become infected and cause a foul vaginal discharge. Within the peritoneal cavity, however, they are less likely to become gangrenous, and if interference with the circulation has been gradual, they occasionally become surrounded by a more or less calcareous capsule. Several authors have reported finding such tumors free in the cul-de-sac of Douglas. In most cases, however, the interference with circulation causes a more rapid degeneration which results in a low grade localized peritonitis. To protect the rest of the abdominal cavity, nature walls in the degenerating tissue with adhesions to the surrounding structures. If gangrene has not already commenced, these adhesions will act as a new source of blood supply. Vessels will rapidly increase in size and in many cases fibromyomata will be found still attached to the uterus; but, from the size and distribution of vessels in the attached structures, it is readily seen that the acquired or abnormal attachments are the main sources of blood supply, and it is evident that, as the forces or circumstances that first tended to interfere with the primary circulation to the tumor still exist, the myoma will ultimately be completely severed from the uterine body and will become in every sense of the word a sequestrated or parasitic tumor. Any of the structures in the lower abdomen or pelvis may become

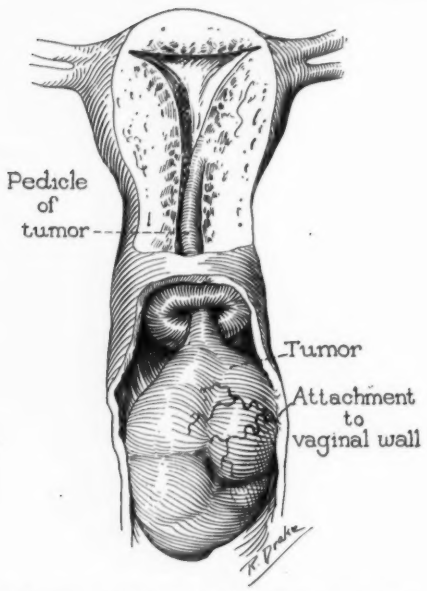

Fig. 4. Vaginal, partially parasitic fibromyoma.

adherent to such a tumor and eventually give it a new or acquired circulation. There is no doubt that in some cases the adhesions to the fibromyoma started as the result of pelvic peritonitis. On account of the increase or decrease in the size or change in the position of the uterus coincident to pregnancy or the development of other pelvic tumors, the circulation to the fibromyoma is somewhat impaired. This calls for an increase in the acquired vascular connection, and in the occasional case the tumor becomes completely severed from the uterus, and its future growth depends on the richness of this new blood supply.

Kelly and Cullen have emphasized the importance of the omentum in protecting the abdomen from general peritonitis as the result of degeneration in myomata. In their series of cases, they illustrate various stages in the development of such tumors. When the tumor is small and receives some sustenance from other vessels there is little or no change in the omentum, but if the tumor is large and receives all or practically all of its blood supply from the omentum, there is marked change in this structure. The vessels become larger and the fat disappears, leaving large openings between the vessels which in some cases run free from the transverse colon to the tumor.

Many intraligamentous myomata apparently have no vascular connections with the uterus, but I feel that they can hardly be classed as true parasitic tumors since most of them, at any rate, have developed from the smooth muscle of either the round ligament or the broad ligament and never were connected with the uterus. Some of these tumors grow very large and have been reported as retroperitoneal parasitic fibromyomata.

In some of the reported cases, the condition was suspected before operation, but I feel that a definite diagnosis must be almost impossible before the abdomen is opened. In some cases, however, there is a suggestive history of degeneration in a myoma with slight elevation of temperature and pulse rate and definite tenderness on palpation of the tumor which is, as a rule, recognized as being attached to the uterus by a pedicle. As the symptoms disappear, the possible development of a secondary circulation can be suspected, and in time such a tumor may become completely separated from the uterus.

Kelly and Cullen reported only two cases of true parasitic myoma, but a great many in which the tumor was partly parasitic. I shall report six cases of fibromyoma, in three of which the tumor was truly parasitic. Of the three cases with a partially parasitic fibromyoma, the tumor was intraperitoneal in one (Case 4), retroperitoneal in one (Case 5), and vaginal in one (Case 6).

ILLUSTRATIVE CASES

CASE 1. A woman, aged 45, came to the clinic July 8, 1925, complaining of stomach trouble. Menstruation started when the patient was 15 and had been quite normal in every respect. She had had an apparently normal menopause one year before admission. She gave a definite history of having had duodenal ulcer for several years, but whatever pain she had was generally in the lower abdomen. She also complained of some aching in the lower part of the back when she was tired. Rectal examination showed the uterus to contain many small fibromyomata; the pelvis was apparently normal in all other respects. The tonsils showed definite evidence of infection; marked dental sepsis was also present.

A diagnosis of duodenal ulcer and numerous small fibromyomata of the uterus was made and operation advised for the ulcer. Operation, July 10, confirmed the diagnosis of duodenal ulcer, and gastro-enterostomy was performed. The uterus was found to contain numerous small fibromyomata, and a mass 6.5 by 3 by 3 centimeters was found wrapped up in the edge of the omentum (Fig. 1). This was removed and the pathologist reported it to be a degenerating calcareous parasitic fibromyoma. It had no connection with the uterus whatever. Convalescence was uneventful.

I believe that some of the low abdominal pain of which the patient complained was due to interference with the circulation of the fibromyoma which at the time of operation was receiving its entire blood supply from the great omentum

CASE 2. A widow, aged 59, registered at the clinic October 8, 1918. Her chief complaint was goiter, which had been noticed 24 years before. Thyroidectomy was advised and performed October 15, 1918. Physical examination showed the presence of an abdominal tumor extruding into the pelvis and filling it. A subtotal abdominal hysterectomy was performed and both ovaries and tubes were removed, because of a calcareous fibromyoma the size of the uterus of a 6 months' pregnancy. A parasitic calcareous myoma, 15 by 12 by 6 centimeters, which was walled in by the omentum and several loops of small intestine and connected to the fibromyoma in the uterus by a few filmy adhesions, was also removed. The operation was difficult on account of the adhesions, and considerable raw surface was left on the loops of small intestine which were connected with the parasitic tumor. The patient had two large gall stones, the removal of which should be considered later. The appendix was atrophic and was not disturbed. The patient made a good recovery.

CASE 3. A widow, aged 33, came to the clinic September 23, 1919. She complained chiefly of fever and general weakness. Menstruation began at the age of 16 with periods and flow normal in every respect. There had been a brownish discharge from the uterus during the entire month for a period of 2 years which necessitated the wearing of a napkin. There was no history of abnormal bleeding at the menstrual periods. A diagnosis of uterine fibromyoma had been made by her physician. Examination showed a large pelvic tumor rising to the level of the umbilicus which was thought to be attached to the uterus. October 2, 1919, through a low incision in the median line, the tumor was explored and found to be a true parasitic fibromyoma undergoing degeneration and completely walled in by the omentum. There was considerable soiling from the spilling of necrotic material, and it was thought advisable to insert a drain. The pathological report was necrosing detached fibromyoma. The patient's recovery was satisfactory.

CASE 4. A married woman, aged 40, came to the clinic July 13, 1925, complaining of menstrual disturbance and of a pelvic tumor which had been present for a period of 2 months. The periods had always been regular every 4 weeks until June, 1925, but for the last 6 or 8 months, the flow had been about 25 per cent more profuse than before and required about three or four napkins a day. The June period was missed, and July 4 at the regular time there was a gush of blood followed by a very profuse flow for a few hours. Eight hours from the time of the onset the flow had practically ceased. A month previous to her visit to the clinic the patient discovered a large lumpy tumor in the lower abdomen and also marked distention.

She was a fairly well developed woman of 5 feet, 7 inches, weighing 135.5 pounds. The tonsils were cryptic and the teeth showed evidence of much dental work. The thyroid was palpable. There was a large irregular tumor arising out of the pelvis, situated more to the left than the right and extending above the umbilicus; it felt firm and nodular like multiple myomata. A diagnosis of multiple fibromyoma was made and operation advised. July 20, 1925, subtotal abdominal hysterectomy was performed for multiple fibromyoma of the uterus; one partially parasitic fibromyoma was found; the left tube and ovary and appendix were also removed. The uterine fibromyomata formed a mass the size of a uterus at 6 months' pregnancy. The circulation from the uterus to the fibromyoma on the anterior surface was markedly disturbed, the tumor getting a good deal of its blood supply from adhesions to the bladder (partially parasitic fibromyoma, Fig. 2). The appendix showed definite evidence of disease.

CASE 5. A woman, aged 50, registered at the clinic November 29, 1921. She had been married at the age of 33 and had never been pregnant. Menstruation began at the age of 14 years and had been fairly regular with a moderate flow until the past year. For a year previously she had suffered from rather severe backache and a heavy pressing feeling in the lower abdomen. The backaches were intermittent, the attacks lasting 2 or 3 weeks, and the intermissions from 5 to 6 weeks. For the preceding year menstruation had been irregular at intervals of from 3 to 6 weeks; the amount was variable and there was no clotting.

She was a well nourished woman 5 feet, 9 inches tall, weighing 200 pounds. The teeth and tonsils were septic. Arterial hypertension was present. There was a large tumor in the pelvis and abdomen. The tumor was explored through a low incision in the median line and found to be a single degenerating fibromyoma, about the size of a uterus in an 8 months' pregnancy, attached by a pedicle to the cervix and lying entirely behind the peritoneum (Fig. 3). The uterus contained several other very small fibromyomata, but on account of the retroperitoneal dissection, hysterectomy did not seem advisable in the absence of symptoms from the

fibromyomata. The pathological report was a single degenerating cystic fibromyoma of the uterus. Recovery was satisfactory.

This case of pedunculated fibromyoma is reported simply to illustrate how some of the retroperitoneal fibromyomata may be true parasitic tumors.

CASE 6. A woman, aged 50, registered at the clinic December 14, 1922, complaining chiefly of tumor. She also complained of a dull pain in the left lower quadrant, constant for many years, and brought on by hard work; it had been continually growing worse. She was relieved when lying on her back. Six months before, she first noticed a protrusion from the vagina which came on after she had done some hard pumping; she went to bed and the protrusion disappeared. It was not noticed again until 2 weeks before her admission, when it again appeared and remained for several days. The patient was finally unable to urinate. Her physician catheterized her and replaced the tumor. Following this procedure there was a discharge of about a pint of foul-smelling, blood-stained pus; this discharge continued for a day or two afterward. There had been no fever. For 6 years before admission she had flowed once or twice a year with apparently normal periods. She had had hot flashes, and so forth.

She was a poorly nourished woman, 5 feet, 5 inches tall, weighing 129 pounds. The tonsils were cryptic and only one tooth remained. The bladder was full and rigid, and the patient was apparently unable to empty it. A movable tumor, which tended to bleed on manipulation, was found filling the vagina. A diagnosis of fibromyoma of the uterus was made and operation seemed indicated. A pedunculated submucous fibromyoma which was protruding through the cervix was removed. The fibromyoma was adherent to the left lateral wall of the vagina (Fig. 4), and during the separation the mucous membrane was torn slightly; this was sutured with chromic catgut. The pathological report was pedunculated submucous fibromyoma weighing 130 grams. The patient recovered satisfactorily.

This case is reported to show the possibility of a uterine fibromyoma becoming parasitic in the vagina.

CONCLUSIONS

1. True parasitic fibromyoma is very rare.
2. It is difficult to diagnose.
3. It should be removed because it may interfere with the function of important organs and because malignant changes may develop.
4. It may adhere to any of the lower abdominal or pelvic structures or some other part of the uterus itself, or the vaginal wall, and its removal may thus become difficult.

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PITUITRIN ADMINISTERED AT THE BEGINNING OF THE THIRD STAGE OF LABOR[1]

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DURING the past 3 years, at the Evanston Hospital, one-half cubic centimeter of pituitrin has been injected intramuscularly at the beginning of the third stage of labor as a routine procedure. In order to estimate the value of this procedure, the records of 1,000 consecutive cases in which pituitrin was used were reviewed and the results compared with 1,000 earlier cases in which pituitrin was not used. Special consideration was given to: (1) the duration of the third stage of labor, (2) the amount of blood lost during the third stage of labor, (3) the number of cases requiring manual removal of the placenta, and (4) the number of cases of postpartum hæmorrhage.

The 1,000 patients of the control series were delivered in 1920, 1921, 1922; the patients of the pituitrin series in 1923, 1924, and 1925. In both series the placentæ were routinely expressed by mild Credé as soon as there were any signs of beginning separation.

Table I shows the effect of pituitrin on the duration of the third stage of labor. A comparison is made between results in the cases in which pituitrin was administered and those in which it was not administered.

For a fuller analysis of the effect of pituitrin the cases are divided into spontaneous and operative deliveries and again into spontaneous and induced labors. These groups are subdivided into primiparæ and multiparæ and in the induced labor cases a further subdivision is made showing whether labor was induced with castor oil, quinine, and pituitrin, or with the Vorhees bag. Analysis of Table I shows that the average duration of the third stage of labor in the pituitrin cases was definitely shorter in each group than in the non-pituitrin cases, regardless of the type of delivery or whether labor was spontaneous or induced and regardless of the mode of induction of labor.

It would also appear that the use of pituitrin in induction of labor did not prevent its effect when given again at the beginning of the third stage of labor.

Table II shows the effect of pituitrin on the amount of blood lost in the third stage of labor. As in Table I a comparison is made between cases in which pituitrin was used and those in which pituitrin was not used. The cases are again grouped as in Table I. It is seen that in every group the average amount

TABLE I.—EFFECT OF PITUITRIN ON DURATION OF THIRD STAGE OF LABOR

			Non-pituitrin cases				Pituitrin cases			
			No. Cases	Time in minutes			No. Cases	Time in minutes		
				Shortest	Longest	Average		Shortest	Longest	Average
Spontaneous delivery		Primiparæ	246	4	80	14.1	248	2	47	9.7
		Multiparæ	506	1	100	12.	510	1	100	9.1
Operative delivery		Primiparæ	169	5	40	13.2	156	3	60	10.1
		Multiparæ	70	2	35	12.2	86	3	50	8.7
Spontaneous labor		Primiparæ	486	4	80	13.7	505	3	63	9.9
		Multiparæ	532	1	100	12.1	515	1	100	8.8
Induced labor	P.	C. O. Q. & P.	13	4	40	11.9	26	3	20	8.3
		Vorhees bag	19	5	50	14.	13	5	37	9.8
	M.	C. O. Q. & P.	30	4	25	13.2	58	4	100	10.8
		Vorhees bag	20	3	16	9.5	23	4	20	9.

[1]Read before the Chicago Gynecological Society, March 19, 1926. (For discussion, see p. 716.

TABLE II.—EFFECT OF PITUITRIN ON AMOUNT OF BLOOD LOST IN THIRD STAGE OF LABOR

		Non-pituitrin cases				Pituitrin Cases			
		No. Cases	Amounts in c.cm.			No. Cases	Amounts in c.cm.		
			Smallest	Largest	Average		Smallest	Largest	Average
Spontaneous delivery	Primiparæ	246	50	800	214	248	20	500	163
	Multiparæ	506	25	900	186.9	510	25	1000	173.4
Operative delivery	Primiparæ	169	25	1000	281.9	156	30	1200	251.8
	Multiparæ	79	50	1500	295.6	86	30	550	218.5
Spontaneous labor	Primiparæ	386	50	800	235.7	365	25	900	195.8
	Multiparæ	532	50	900	201.1	515	25	1000	180.6
Induced labor P.	C. O. Q. & P.	13	150	500	230.7	26	50	450	185.5
	Vorhees bag	19	50	1000	372.3	13	50	1200	273.8
Induced labor M.	C. O. Q. & P.	30	30	700	221	58	30	400	175.4
	Vorhees bag	20	50	400	196	23	25	400	180.4

TABLE III.—SUMMARY OF EFFECT OF PITUITRIN ON THIRD STAGE OF LABOR

	Pituitrin	Control
Average duration of third stage in minutes		
Primiparæ	9.5	13.9
Multiparæ	9.2	11.8
Average for both	9.3	12.9
Average amount of blood lost in cubic centimeters		
Primiparæ	211.9	266.9
Multiparæ	185.3	220.1
Average for both	198.7	243.5
Cases of manual removal of placenta		
Primiparæ	12	17
Multiparæ	10	8
Total for both	22	25
Cases of postpartum hæmorrhage, 500 cubic centimeters		
Primiparæ	14	37
Multiparæ	11	34
Total for both	25	71

TABLE IV.—CASE OF MANUAL REMOVAL OF PLACENTA

	Pituitrin	Control
For postpartum hæmorrhage		
Primiparæ	8	12
Multiparæ	9	5
Total	17	17
For constriction ring		
Primiparæ	4	5
Multiparæ	1	3
Total	5	8

of blood lost is somewhat less in the pituitrin cases than in the non-pituitrin cases. It is here again evident that the use of pituitrin in the induction of labor does not prevent its effect when given at the beginning of the third stage of labor.

Table III gives a summary of Table I and Table II, and also the number of cases of manual removal of the placenta and the number of cases of postpartum hæmorrhage in which the amount of blood lost was estimated to be over 500 cubic centimeters. A division into primiparæ and multiparæ is made. It is to be noted that the total number of cases in which manual removal of the placenta was necessary is no greater in the pituitrin series, and that the number of cases of postpartum hæmorrhage was only about one-third as many in the pituitrin series.

Because of the theoretic possibility that pituitrin might be a cause for the production of constriction ring Table IV is given showing the number of cases of manual removal of the placenta which are divided into those necessitated by (1) postpartum hæmorrhage or to terminate the third stage of labor and, (2) constriction ring. It is seen that constriction ring was a less frequent cause for manual removal of the placenta in the pituitrin than in the control cases and that postpartum hæmorrhage and need of terminating the third stage of labor were a no more frequent cause for the manual removal of the placenta in the pituitrin than in the non-pituitrin cases.

The length of labor was also noted, and a rather interesting observation was made which is probably only a coincidence and has nothing to do with the use of pituitrin, namely: the average length of labor of the primiparæ in the control series was 15.7 hours, in the pituitrin series 12.9 hours, 2.6 hours shorter in the pituitrin series. In the multiparæ of the control series the average length of labor was 9 hours, in the pituitrin series 7.5 hours, 1.5 hours shorter in the pituitrin cases.

CONCLUSIONS

Pituitrin was administered intramuscularly in dosage of one-half cubic centimeter at beginning of the third stage of labor and we found:

1. It definitely shortened the third stage of labor.
2. It lessened the amount of blood lost in the third stage of labor both in spontaneous and operative deliveries.
3. It lessened the number of cases of postpartum hæmorrhage.
4. It diminished the frequency of retained placentæ due to constriction ring.

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SYMMETRICAL CONGENITAL BRACHYDACTYLIA

Report of Five Cases

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CONGENITAL bone abnormalities are now being studied with great interest. Many unsuspected abnormalities have been discovered with the aid of the X-ray. Some of the hitherto undefined bone diseases have been cleared up through these studies. Some types diagnosed as fractures are now being correctly classed as congenital abnormalities of the bones; hence the advisability of taking radiograms of the affected and the apparently normal sides for comparison. Abnormalities of the carpals and tarsals are of very frequent occurrence. Following the work of Dwight (4), Geist (6) has made careful studies of the tarsals and has contributed valuable articles showing the additional number and great varieties. Scoliosis has been found to be due to abnormal vertebræ. The region of the lumbosacral joints is still a fruitful field for these studies as evidenced by many recent articles in the orthopedic journals. Deformities of the metacarpals and metatarsals are not commonly reported. Dwight states: "There is a long type and a short type of metacarpal variation. The short is more important, as it is often at least one-half of the ordinary length. Two or three fingers may be affected in one or both hands though without perfect symmetry." He records only one case showing shortening of the fifth metacarpal and calls it a remarkable incident. He mentions nothing about metatarsal shortening. Day (3) and Lewin (8) report cases of short metacarpals.

I trust, therefore, that the report of the following five cases which includes one with complete description, roentgenograms of two cases in the same family, and a review of two similar cases previously reported by me (1), will be of interest.

Olivia M., female, age 17, referred to me by Dr. B. A. Turkel for scoliosis. The physical examination of the patient showed a scoliosis dorsolumbar following an empyema and rib resection. On examining the extremities I found that there was a shortening of the fourth toe on the right side and third and fourth on left. One could easily surmise that the defect was in the metatarsals. She had double weak feet but otherwise the feet looked normal.

The hands also showed a congenital abnormality. They were rather small for a girl of her age and size. The right hand had shortening of the middle finger, the tip reaching only to the tip of the ring finger. Left hand also had short middle finger though not as short as the right.

Roentgen-ray examination by Dr. T. B. Weinberg showed short fourth metatarsal on right (Fig. 1), short third and fourth metatarsal on left together with an ostrigonum—extra astragalus (Fig. 2 and 3). The third, fourth, and fifth metacarpals of both hands were short (Figs. 4 and 5). The spine showed a slight abnormality in the body of the fifth.

In order to clear up the hereditary history, Dr. Weinberg examined and took roentgenograms of the other members of the family. He found that the father had short fourth fingers, the one on the right hand being the longer. The roentgen-ray showed that the short fourth metacarpal of left hand was exactly the same shape as the one of the daughter (Fig. 6).

He found that a younger sister, aged 12, had small third and fourth right and left metatarsals. He found that she had shortening of the last two toes on the right side and the last three toes on the left. Hands had shortening of the little and ring finger on the right but not as much as the ones of her sister. There was also shortening of the left little finger.

There may be some other member in the family with the same deformity but we are unable to trace them at present.

This case is no doubt hereditary as abnormalities were found in other members of the family.

I will now review the report of my first two cases published in 1916 as the deformity was similar to this one.

Case 1. M. L., female, aged 35, consulted me for pain in her feet. Examination showed a plain case of double weak feet. On inspection, I discovered that the fourth toes of both feet were shorter than normal. While I was trying to find where the defect lay, the woman voluntarily offered the information that the deformity was congenital and that both hands showed exactly the same peculiarity. The hands really presented shortening of both ring fingers, the tips of these were even with the tips of the little fingers, and the knuckles of the ring

Fig. 1. Case 1. O. M. Roentgenogram showing right foot. Note short fourth metatarsal and change in the first phalanx of that toe.

Fig. 2. Case 1. Left foot. Note short third and fourth metatarsals with changes of first phalanges.

Fig. 3. Case 1. Left foot. Note the os trigonum.

fingers were on a higher level than the knuckles of the other digits. There was no complaint of weakness of the hands and the muscular power was normal.

On inquiry into the hereditary history she told me that her two sisters, an uncle, an aunt, her grandmother, and four other members of the family showed exactly the same defect, and that was the reason why she never worried about the unsightly appearance of her finger on which she wore her marriage ring. She said that there might be some more relatives with the same deformity, but she was not acquainted with them. (I did not make out a family tree.)

Roentgenograms (Figs. 7 and 8) showed clearly the shortening of the fourth metacarpals in both hands. The fourth metatarsals are also shorter than normal.

Case 2. A. F., female, aged 19, came to me complaining of cold feet, which on examination was shown to be due to poor circulation with low arterial pressure. On examination of the upper extremities, the little fingers were found to be shorter than normal, the tip reaching to about the middle of the mid-phalanx of the ring finger. There was nobody in her family who had a similar deformity. Roentgen-ray showed shortening of the fifth metacarpals (Fig. 9).

When the article containing the reports of the last two cases was published, Dr. Congughan sent me a photograph of a patient that he had had with similar deformities and wrote that the father had the same abnormalities (Fig. 10). He mentioned that the distal phalanx of the thumb of these two patients was short.

Fig. 4. Case 1. Right hand. Short third, fourth, and fifth metacarpals.

Fig. 5. Case 1. Left hand. Short third, fourth, and fifth metacarpals.

Fig. 6. Roentgenograms showing right and left hands of the father in Case 1; showing the short right metacarpal while the left is the same in shape as the left metacarpal in Case 1.

Fig. 7 (right). Case 4 (previously reported). M. L. Right hand; showing short fourth metacarpal.

Fig. 8. Case 4 (previously reported). Left hand; showing same deformity as the right hand.

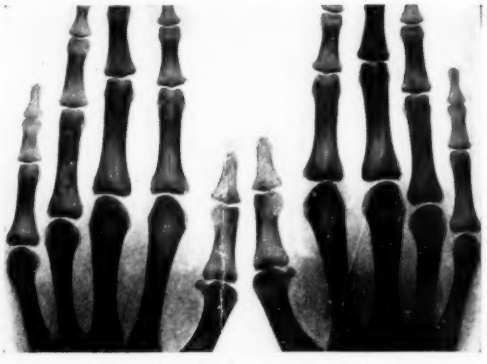

Fig. 9. Case 5 (previously reported). Roentgenogram of both hands; showing the symmetrical shortening of the fifth metacarpals. No one in this family had a similar deformity.

In discussing the cause of these deformities I will quote from a previous article (1) in which I stated: "To discuss the origin or the cause of this particular deformity, we will quote here the statements of the authorities Keibel and Mall (7), who give the following conclusions: 'Agenesis or failure of skeletal development may be due either to primary *lack of origin* of a part or to an affection which destroys the skeleton anlage after it has begun to differentiate. It is found more often in the vertebræ, less often in the bones of the extremities. Hypoplasia or underdevelopment of the skeleton, whether generalized or confined to a part, may be due either to prenatal or to postnatal conditions. The failure of the bones to develop normally may be due (1) to lack of active proliferation of cartilage (characteristic of cretins), (2) to inactivity of the process of ossification, (3) *to a premature union of epiphysis with the main part of the bone*, (4) to growth of connective tissue between the growing cartilage of a bone and the region where ossification usually extends into the cartilage (micromelia, chondromalacia, fetal rickets), and (5) to inflammation and other abnormal conditions affecting the growing parts of the bone.' " In this case one may conclude that it is due to a primary lack of origin of the anlagen rather than to an affection which destroys the skeleton anlagen after it has begun to differentiate, especially when one considers that in all these cases the condition was hereditary. The form is the one due to an early ossification between the epiphysis with the diaphysis. This is shown by the roentgen-ray of our first case. Cohn's (2) studies on development of the metacarpals and metatarsals are of interest in this connection. He says: "Development—Each bone has two centers, a primary one for shaft, appearing early in the third month of fetal life, and one for an end, appearing in the third year. The secondary center is for the distal end in the four inner metacarpals and in the proximal of the first, that is, at the end toward which the nutrient artery does not run. They fuse at about eighteen years.

"The metacarpals are preformed in cartilage and ossify from a diaphyseal center for the shafts and an epiphyseal center in the base. The epiphyseal centers appear after birth." (Roberts and Kelly's *Fractures*.) No mention is made of the period of ossification.

"Metatarsals. Each metatarsal has two centers. The primary center appears in the eighth intra-uterine week, the other appears in the third year of life. Consolidation takes place from the fourteenth to the twenty-first year." (Morris's *Anatomy*.)

"Development. Centers for the shafts of the metatarsals appear toward the end of the third month of fetal life. A proximal epiphysis for the first and distal one for the others appear in the third year, fusing at about seventeen." (Piersol's *Anatomy*.)

"The metatarsal bones are each developed by two centers: one for the shaft and one for the distal extremity in the four outer metatarsals; one for the shaft and one for the base in the metatarsal bone of the great toe. Ossification commences in the center of the shaft about the ninth week, and extends toward either extremity. The center in the proximal end of the first metatarsal bone appears about the third year, the center in the distal end of the other bones between the fifth and the eighth year; they become joined between the eighteenth and the twentieth years. The phalanges are developed by two centers for each bone; one for the shaft and one for the metatarsal extremity. The center for the shaft appears about the tenth week, that for the epiphysis between the fourth and the tenth years; they join the shaft at about the eighteenth year." (Gray's *Anatomy*.)

This indicates that the centers of ossification for the metacarpals and metatarsals do not form just exactly at the same time and hence an amniotic pressure is not liable to give that symmetrical occurrence especially when the father and the daughter have exactly the same deformity and the same shape of the fourth metacarpal shaft.

Gaenslen (5), speaking about bilateral deformity of tibia and fibula makes the following statements which will be of interest here: "The endogenous or germinal theory, absence or defect of the long bones, is dependent upon defect in the anlagen of the skeleton. This view has been warmly defended in recent years by Haim and Slingenberg. According to the latter, the germ defect is variable in extent resulting in corresponding defects in the long bones. If complete, there will be absence of one of the long bones as well as of the corresponding tarsals, metatarsals, and phalanges, the typical Strahldefekt or ray defect of Gegenbaur."

It is difficult to imagine pressure from amniotic adhesions or bands so accurately adjusted as to cause the same deformity in father and child though one would be inclined at first to think so, as this patient shows asymmetry in the shortening of the third metacarpal of each hand (Figs. 5 and 6).

Fig. 10. Case 6. Short metacarpal of the right hand.

On the question of the classification, i.e., under which heading to place these cases of brachydactylia, we suggest following the classification of Steindler (9), viz. "Dysplastic conditions: (1) chondrodystrophy, (2) brachydactylia (some cases), (3) fusion of carpal bones." The brachydactylia is usually due to short metacarpals.

Concerning treatments nothing can be offered. If these studies may not be of immediate help to the surgeon, they may be of help to the biologist. They may, perhaps, be of help in medicolegal cases in deciding whether the deformity is due to injury to mother or hereditary.

CONCLUSIONS

1. Congenital shortening of metacarpals is frequently the cause of brachydactylia (short fingers).

2. Bilateral congenital malformation can generally be traced to heredity, while a unilateral congenital malformation may be explained on principles of embryonic pressure defects.

3. Cases of short fingers should be reported with the same accuracy as polydactylism so as to facilitate the studies of the embryologist.

4. The origin of the metacarpals and metatarsals is similar though the center of ossification may not be so as seen by the similar deformity in my cases.

5. The fourth metacarpal was the most frequently involved in my series.

6. The fourth metatarsal is also frequently involved.

7. The deformity is due to a lack of origin of the anlagen rather than to an affection which destroys the skeleton anlagen after it has begun to differentiate as the condition is so often found in families.

I desire to acknowledge my great appreciation to Dr. T. B. Weinberg for the special interest to examine the other members of the family whom I could not see, also for the careful roentgenograms. I feel that without his aid this study would have been impossible.

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THE X-RAY TREATMENT OF HYPOFUNCTION OF THE OVARY

With Special Reference to the Regulation of Menstrual Function

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THE use of the X-ray in certain diseases associated with disturbed ovarian function is well known. Under a certain dosage, definite changes may be produced which are known as roentgen castration. This dosage depresses or abolishes the ovarian function controlling menstruation, and by destroying the ova produces sterility.

As suggested by Opitz, Van de Velde and Fraenkel were able to induce regular normal menstrual cycles in cases of amenorrhœa and hypomenorrhœa by applying a *fraction* of the dosage required to produce an abolition of ovarian function. If normal regular menstruation and fertility are evidences of normal ovarian function, then delayed, scanty, or absent menstruation and sterility may be said to be symptoms of a hypofunction or a diminished ovarian functional state. The method of treatment to be described has, therefore, been called the stimulative treatment of the ovary, or the treatment of ovarian hypofunction.

On the other hand, in certain cases, menstruation irregular in interval, duration, and amount, occasionally scanty and occasionally profuse, cannot be ascribed either to hypofunction or hyperfunction, but to dysfunction or a disordered function, in which the X-ray treatment acts as a regulator. This explains the double title of the paper, which concerns itself with the treatment of delayed, scanty, or absent menstruation and the sterility usually associated with such symptoms.

The indications for this method of X-ray treatment are circumspectly limited, and it is therefore important that the diagnosis be established with accuracy. What I have stated in a previous article may be repeated.

"The gynecologist and the radiologist are both concerned in the application of the X-ray as a therapeutic agent, and a close co-operation between the two is essential if effects are to be obtained and the treatment properly and honestly applied. Without a correct diagnosis, without proper control by the gynecologist, without a proper selection of cases, the radiologist works blindly and often to the detriment of his patient. In fact, the radiologist is but the assistant of the gynecologist, and the keener his diagnostic ability, the closer his scrutiny of the cases, the more effective are the results. . . .

"In reference to the radiologist, there is to be said that he must apply the rays with brains, that, although certain fundamentals must be adhered to, which are the essentials of technique, he must remember that he has a living human being to deal with, who responds and reacts in manifold ways to the application of this powerful agent, and that as much clinical judgment is necessary in prescribing a dose of radiation, as in prescribing a dose of any powerful drug utilized in medicine."

In this particular work, I have been fortunate in having the co-operation and assistance of Dr. A. J. Rongy, to whom I desire to express my indebtedness.

CLASSIFICATION

The menstrual deficiencies may be classified as follows:

As to cause: (1) essential, due to changes in the generative organs; (2) symptomatic, associated with such systemic diseases as chlorosis, tuberculosis, etc.

As to type: (1) complete cessation—amenorrhœa, for months or years; (2) scanty amount, normal interval—oligomenorrhœa; (3) normal amount, prolonged interval—opsomenorrhœa; (4) scanty amount, prolonged interval—oligo-opsomenorrhœa.

As to the time of its inception: (a) at puberty, (b) after a period of more or less normal menstruation.

INDICATIONS

The form of ovarian hypofunction suitable for this therapy may manifest itself as any one

of the types of menstrual deficiency above described and as an associated sterility. In all the types of cases suitable for treatment, there must be direct or indirect evidence that ovarian tissue exists in sufficient amounts to respond to the action of the radiation.

SYMPTOMATOLOGY

The diminished menstruation can be said to present no serious menace to the general health except when an associated disturbance of other secretory glands is present. There is, however, an important consideration in these cases and that is the disturbance in the emotional and psychical state of the individual affected, since regular menstruation appears to the average woman to be tangible evidence of ovarian normality.

Thus if the menstruation has entirely ceased or is rare or scanty, there may arise an associated state of psychosexual inferiority which cannot be ignored and which as it disturbs the mental equilibrium of an otherwise normal patient may lead to a general depression with an associated train of functional neurosis with vasomotor and metabolic disturbances.

Another and greater consideration associated with disturbed menstrual function is that of diminished fertility.

TREATMENT

Numerous as have been the forms of treatment for the menstrual disturbance resulting from insufficiency of ovarian function, they have all of them been of so little permanent value that there is justification in stating that there is no medicinal therapy which is definitely able to influence ovarian function. This applies to such medication as aloes, yohimbin, and santonin. Nor are such physical measures as baths, thermotherapy, active and passive gymnastics, massage, etc., of any definite value.

The connection of the endocrine glands with the function of the genital apparatus has been recognized in recent years, as quite definite for the ovaries, the thyroid, the pituitary, and the adrenal glands. Consequently, the administration of glandular extracts, either singly or in combinations, for instance, of entire ovary or liquor folliculi, corpus luteum, thyroid, the anterior and posterior lobes of the pituitary gland, has become quite customary in gynecological therapeutics. However, the results have been neither striking nor permanent.

X-ray treatment. The basis for the application of small doses of radiation to the hypofunctioning ovary was the theory that whereas large doses destroy cellular structure and moderate doses inhibit cellular proliferation, small doses directly foster and increase cellular growth and therefore stimulate the functional activity of the particular organ.

It is not necessary here to enter into a discussion as to the correctness of this theory which never had a solid basis of experimental and clinical fact. Let it suffice to state here that every dose of radiation, no matter how small, acts detrimentally on a cell, and that far more illuminating and valuable as a working hypothesis is the idea that small doses of radiation repair cellular disequilibration. Cells are naturally so constituted that they respond to disequilibration with changes which tend to re-establish the old equilibration, provided the disequilibration was not so thorough-going as to lead to irreparable injury. According to the sensitiveness and the character of the cell complex, the amount and character of the disequilibration which can be repaired varies; the character of the cell complex also decides what kind of equilibrium is re-established and by what means it is accomplished. These means often imply temporary excess activity which appears as a stimulative effect.

The disequilibration associated with the symptoms of hypofunction of the ovary affects the sex cycle, in which follicular rupture, ovulation, follicular degeneration, the premenstrual, menstrual, and postmenstrual uterine changes play an important part.

Though at birth there are thousands of primordial follicles in the ovary it is stated that under normal conditions only about 300 go through the cycle of maturation, with corpus luteum formation and final absorption. The remaining ova at one time or another undergo a process called atresia. Of many ripe follicles always to be found in the ovaries of normal women at times other than during

pregnancy, only one follicle ruptures and expels its ovum, not simultaneously with menstruation, but about 15 days after the beginning of the menstrual flow.

It would appear that this follicular rupture is not a haphazard accidental phenomenon or dependent merely on the number and size of the follicles, but takes place under definite control, the ovaries performing this function alternately so that in each ovary, ovulation takes place once in 8 weeks.

The periodicity of menstruation is directed through the regular recurring cycle of changes in the ovary and ovulation is essential for menstruation. The ovary has been compared to the mechanism, the uterus to the hand of the clock, as regards their functional relationship. The mucous membrane of the uterus undergoes a regular cycle of morphological changes, which reach their acme with each menstruation. At the time when the follicle ruptures and releases the ovum, the mucous membrane of the fundus is in a so-called rest or intermenstrual period. Changes now take place known as the premenstrual swelling, which show their characteristic expression in the last few days before the expected menstruation. During menstruation the entire compacta and part of the spongy layer of the endometrium are cast off by the hæmorrhage. About the seventh day after the beginning of menstruation, the mucous membrane is again epithelialized and regenerated, and after another 8 days it has grown again to its original thickness. As soon as complete fusion or substitution has taken place, then the new preparation period commences.

Technique. The treatment consists in the administration of a small dose of radiation to each ovary. The dose necessary to produce the desired effect is 15 per cent of the castration dose delivered to each ovary through two portals. It is necessary to treat both sides because of the alternate ovulation. The four portals which take in all the pelvic structure may be irradiated at one sitting or a portal at a time with intervals of a day or two. The series should not be repeated until after a lapse of several months, but meanwhile a small dose of radiation may be applied to the thyroid or the hypophyses if the status of the patient demands it. A slight variation from the 15 per cent may be necessary, depending: (1) on the age, (2) thickness of abdominal wall, and (3) duration of ovarian hypofunction. There should be no irradiation sickness and no change in the skin of the portals treated.

It is to be pointed out that X-ray treatment of a patient showing no results must not be continued. The possibility exists that even the relatively small dose, unless carefully administered, may produce permanent amenorrhœa in women in the menopause age.

This treatment is of course contra-indicated in symptomatic amenorrhœa when it is associated with such general systemic diseases as lues, tuberculosis, nephritis, pernicious anæmia, and also when it is secondary to adnexal disease, tumors, or cystic disease of the ovary. Amenorrhœa in advanced age, or of very long duration; amenorrhœa resulting from curettages after numerous abortions, does not respond to this treatment. In dystrophyadiposogenitalis, the involvement of other endocrines may necessitate other treatment.

ANALYSIS OF RESULTS[1]

Thirty-eight cases are here studied. In 25 of the cases menstruation appeared after the treatment and in the majority of cases followed regularly during the entire period of observation while the somatic and psychical symptoms of the ovarian hypofunction disappeared rapidly after menstruation set in. The longest period of amenorrhœa to be

TABLE I.—AGE INCIDENCE

Entire Series		Successful Cases	
Ages	Cases	Ages	Cases
16 to 20	1	16 to 20	0
21 to 25	10	21 to 25	6
26 to 30	17	26 to 30	14
31 to 35	7	31 to 35	4
36 to 40	3	36 to 40	1
Total cases studied	38	Total	25

	Successful Cases
Regular menstruation—no pregnancy	18
Regular menstruation—pregnancy	7
Total number	25

Ages	Cases	Ages	Cases	Ages	Cases
21	2	27	2	33	1
22	1	28	2	34	1
24	2	29	1	35	1
25	1	30	5	37	1
26	4	31	1		25

[1] A recapitulation of the final results will be reported later.

TABLE II.—SUCCESSFUL CASES

No.	Age	Para	Interval between last menstruation and treatment Months	Interval between treatment and result Weeks	Comment
1	21	0	9	5	Regular. Reduction in weight.
2	27	0	8	10	Regular for 8 mos. *Pregnancy*—normal birth.
4	24	0	4	4	Amenorrhœa for 18 mos. prior to marriage. Regular for 10 mos. *Pregnancy*.
6	21	i	4	4	Regular for 2 mos. *Pregnancy*.
12	34	i	17	4	Regular. Weighed 220 lbs. Reduction.
11	30	0	3	8	Regular. Profuse.
15	27	0	4	4	Regular. *Pregnancy*—premature birth.
16	35	0	8	16	Regular. Two series—last 50 per cent.
17	30	ii	3	4	Regular. *Pregnancy*—birth normal.
18	26	0	6	4	Regular.
20	29	0	5	4	Regular.
21	30	0	36	7	Regular but scanty.
22	28	0	18	4	Regular.
24	28	0	24	4	Regular.
25	26	0	5	4	Regular. *Pregnancy* (unterminated).
26	37	0	72	4	Regular—5 days for one period.
27	22	0	6	7	Regular.
29	26	ii	1	3	Regular—3 days (1 day menses.)
32	25	0	2	2	Regular. (4 mos menses.)
33	24	0	7	7	Regular. Reduced weight 47 lbs.
34	31	0	½	2	Reduced weight 30 lbs. Changed from 1 day to 4 day type.
35	26	0	7	7	Regular. *Pregnancy* (unterminated).
36	30	0	1	4	Regular. (Previous interval 7 mos.)
37	30	0	¼	3	Regular. Changed from ½ day to 3 day type.
38	33	i	1	5	Regular. (Previous interval 4 mos.) Changed to 4–5 day type.

followed (after irradiation) by a menstruation was 6 years. A successful result was obtained in a woman of 30 years (Case 21), who had not menstruated for 3 years. In Case 34, an obese woman with a small undeveloped uterus, a narrow pelvis, and sexual anæsthesia, the menses changed from a one day watery flow to a normal 4 day menstruation, and she lost 30 pounds. Though in some of the cases, the menstrual cycles did not persist, the prompt reaction following the radiation was a striking evidence that the treatment is effective if a functionating vestige of the ovary remains. Thus in a woman of 37 who had not menstruated for 6 years, only one menstruation period followed the treatment. The regulating effect is apparent in Case 38. This woman, aged 33, gave a history of amenorrhœa for 5 years after childbirth. She had menstruated 4 months before treatment, and then 1 month before the treatment when the flow lasted for 12 days. Following the treatment there has been regular 4 to 5 day menstruation every month.

The interval between the first radiation and the menstruation varied, but in the majority of cases it was about 28 days. In two cases the duration was 2 and 3 weeks. It was not less than 2 weeks. In 4 cases menstruation appeared 7 weeks after the treatment. In Case 2 it appeared 10 weeks after treatment and after 8 regular periods this patient became pregnant. In Case 16, a sterile woman of 35, it appeared 16 weeks after a second partial dose had been given, the first dose 3 months before having failed to produce results.

In some of these cases, simultaneously with the regulation of menstruation, dysmenorrhœic symptoms were favorably influenced. In other cases there was no improvement of the dysmenorrhœa, in spite of improvement of menstrual function. In some cases the pain with the first menstruation was extremely severe.

In some cases of oligomenorrhœa, the increase of the menstrual function was abnormal. In certain cases of hypomenorrhœa in which there was a marked adiposity with the menstrual disturbance, the adiposity was reduced after the onset of menstruation without any other therapeutic measure. One of these patients lost 13 pounds after treatment, one 47 pounds, and one 60 pounds.

PREGNANCY

Besides this there are 8 cases treated for hypomenorrhœa in whom, following regular menstrual periods, pregnancy ensued.[1]

All of these patients previously had shown symptoms of a defective ovarian function. Before pregnancy there was a period during which the menstruation became regular. The ages were 21, 24, 26, (3) 27, (2) 30. Premature birth occurred in 1 case. One of the patients was a i-para and one a ii-para, and 6 others had never been pregnant before. Two patients, Cases 18, 25 and 35, are now pregnant. Of 5 births there were 4 healthy normal living children.

TABLE III.—PREGNANCIES‡

In primipara	5
In i-para	1
In ii-para	1
Total	7
Premature birth (due to nephritis)	1
Normal termination	4
Unterm nated	4

No.	Age	Married	Para	Interval between last menstruation and treatment Months	Interval between irradiation and result Weeks	Notes
2	27	5	0	9	10	Menstruation for 8 mos. Pregnancy. Normal birth.
4	24	4	0	4	4	Had ceased for 18 mos. prior to marriage. Pregnant after 10 menstruations. Normal birth.
6	21	3	i	4	4	Pregnant after 2 menstruations. Normal birth.
15	27	5	0	4	4	Pregnant after 3 menstruations. Premature infant, nephritis. September, 1925—pregnant again.
17	30	8	ii	3*	4	Pregnant after 2 normal menstruations. Normal birth.
25	26	7–12	0	5†	4	Pregnant after 7 normal menstruations. Now pregnant.
35	26	5	0	7	7	Pregnant after 12 normal menstruations. Now pregnant.

*Stillbirth; q. 4–5 mos.
†q. 2–3 mos
‡Since this report was submitted Case 187, 26 years old, reported herself as pregnant after three normal menstruations.

[1]Linzenmeier reported the cases of 2 women who, some time after irradiation of the ovaries (in 1 case for fibroma and in the other for menorrhagia) became pregnant and were delivered of normal infants at term. In the first case, the woman received two irradiations over the right abdomen. In the second case, irradiations were given abdominally and dorsally. The pregnancy occurred a year later. In both cases weak dosage had been used. Neither of the women previously had had children, although both had been married for several years. Linzenmeier, in 8 cases (as reported in the literature) of pregnancy following irradiation, found a malformation of the child in only 1 case.

Failures. The treatment failed to achieve the desired result in 13 cases. Analysis of these cases is of great interest since it aids in defining the limitation of this treatment. A study of these cases would indicate that the failure of the treatment may be the result of one or a combination of several conditions.

Premature menopause. In 2 cases the age was 36 years. One of these patients, Case 10, had menstruated 12 times in the last 18 years, her last menstruation having taken place 6 years before treatment; and the other, Case 3, had menstruated 3 times in the last 5 years, the last flow having taken place 4 months before treatment.

Developmental deficiency. One patient, Case 8, had at the age of 24 menstruated only twice, once at 6 and once at 16 years, and had stained once 4 months after marriage. There was a history of flushes. The left ovary was not palpable and the right was small and hard. A small sella turcica was present in this case. There was sexual anæsthesia. This would indicate a very marked congenital maldevelopment of the genital tract with ovarian deficiency. In this category may also be placed the cases of oligomenorrhœa, Cases 7, 9, 14, 19, and 31, in which menstruation was markedly irregular from the first and various uterine and ovarian stigmata indicated undeveloped or degenerated sex organs.

Pelvic infection. In Case 23 the patient was 30 years old. Her condition remained unchanged after treatment. She spotted for a few hours for one day. Her irregularity began after a miscarriage 7 years ago. In this case and in Case 5, the cause of failure was probably an old pelvic infection. In Case 28, the oligomenorrhœa dated from the last childbirth. As a result of the treatment, she had at the next period severe cramps for 3 days, but the watery discharge for 1 day was the same as usual.

TABLE IV.—FAILURES

No.	Age	Para	History	Remarks
3	36	ii	Menses irregular. Three times in 5 years.	Failure due to age. Probably premature menopause.
5	21	o	None for 3 months.	Insufficient treatment. Inflammatory process in pelvis.
7	27	o	Always irregular. Last menses 18 months ago.	Atrophic cystic degeneration of the ovaries.
8	24	o	Once at 6. Once at 16. Stained once 4 months after marriage. Had flushes for some time. Sexual anæsthesia.	Congenital ovarian deficiency. Uterus, small and retroverted. Left ovary not palpable. Tried diathermy.
9	29	o	Always irregular and increasingly so.	Amenorrhœa 1 year.
10	36	o	12 times in last 18 years. Had flushes some time ago. Last menstruation 6 years before treatment.	Ovaries not palpable. Dark skin. Hypertrichosis. Defective development of generative organs.
13	31	i	Always irregular. Last menstruation 8 months before treatment.	Cause of failure unknown.
14	26	o	Always irregular. Last menstruation 11 months ago.	Congenital ovarian deficiency.
19	18	o	Always irregular. Last menstruation 9 months ago.	Congenital retroversion.
23	30	o	Stained for last 7 years with pain.	No change, same as before treatment. Infection following miscarriage, 7 years ago.
28	22	o	Irregular for 16 months. Fibroid uterus.	Cramps. No result. Cause, probable beginning fibrosis.
30	23	o	For sterility. Menstruation regular.	Small hypoplastic uterus. Sexual anæsthesia.
31	23	o	Always irregular. Last menstruation 5 months ago.	Probably cyst of ovary.

In Case 30, treatment was instituted for sterility, menstruation being normal.

It is perhaps of interest to state that the very close observation and analysis of the physical condition in these cases disclosed no rejuvenation effects nor were there any changes as regards libido. Effects as described by Steinach and Fraenkel could not be observed in the cases studied.

MODE OF ACTION

The mechanism by which the radiation produced the desirable effects is a difficult problem. In the consideration of this question, it is perhaps important to understand that the histological changes indicate no such difference in the sensitivity of the various ovarian cellular structures as would permit us to reason that a specific effect has occurred in any particular part of the ovary. Even with the relatively small dosage administered, the ovarian follicular structure in all stages of development, the structures of the cortex and medulla, were similarly affected. The effect may be produced through action[1] on the (1) corpus follicularis (ruptured follicle), (2) graafian follicle (unruptured), (3) ovarian stroma (hormonal action), and (4) uterine mucosa.

TABLE V.—ANALYSIS OF RESULTS IN THE FAILURES

Ages	Cases
16 to 20	1
21 to 25	5
26 to 30	4
31 to 35	1
36 to 40	2
Total number of cases	13
Failures due to premature menopause (?) (Cases 3 and 10)	2
Failures due to congenital deficiency of genital tract development, Cases 7, 8, 9, 14, 19 31	6
Failure due to unknown cause (Cases 30 and 13)	2
Failures due to previous pelvic infection (Cases 5, 23, and 28)	3

*The effect of radiation on the corpus folliculari*s. Though the relation of the cause and effect between follicular rupture and uterine changes have not been established beyond all doubt, it is generally conceded that the corpus follicularis from the moment of its rupture, if not before, is a chemically active body until its period of involution or absorption.[2] The

[1] Geller studied the effects of mild irradiation of the ovaries in rabbits. As compared with the ovary of the control, the ovary of the irradiated animal usually showed degeneration of the follicular apparatus which was recognizable quantitatively but not qualitatively from that occurring under normal physiological conditions. The first sign of degeneration occurs always in the ovum. Later the granulosa cells show changes. The ova of the primary follicles show the degenerative changes most pronouncedly in the nucleus which loses its round shape and owing to irregular chromatin distribution is occasionally darker, more often faintly stained, and finally disappears completely. The flat epithelial cells of such follicles atrophy and eventually become detached. The ova of the larger follicles lose their round shape; the fine net-like protoplasm stains more intensely with eosin, becomes stringy, and often contracts away from the zona pellucida which finally disappears. Frequently the egg cell changes to a homogeneous hyaline ball but here also the nuclear changes are the same as those in young ova. The granulosa of the larger follicles degenerate. There is a casting off of the degenerated granulosa cells into the interior, invasion of leucocytes and swelling of the theca interna. There next follows either a contraction of the follicular cavity or a cystic degeneration of the follicle.

[2] According to Loeb, there are two factors in the sexual cycle. The first factor is associated with the ovary rather than the corpus luteum. The wall of the maturing follicle secretes a substance which causes circulatory changes, growth processes, certain physical alterations and proliferation in the mammary glands, vagina, and uterine walls, and in a manner is responsible for growth changes in the ovary itself, culminating in ovulation, which leads to corpus luteum formation. The second factor in the sexual cycle is controlled by substances secreted by the corpus luteum. These secretions sensitize the uterus, make possible the formation of decidua or predecidual proliferation, and facilitate the fixation and development of the fertilized ovum. They prevent proœstrum, œstrum, and ovulation. There is an intermediate or a degenerative stage between the first and second factors.

corpus follicularis exerts its local influence as a regenerative mechanism governing the chemical metabolic processes and the physical pressure relationships in the ovary so that through it, the growth and ripening of the remaining follicles are influenced. It may be conceived as being a sort of inhibiting body only through the involution of which the remaining follicular apparatus can return to full function. The continued growth of the corpus follicularis during pregnancy may exercise an inhibitory effect on the ripening of the follicles during this period and on the catabolic regression of anabolic phenomena of this fertile sex cycle. Should the corpus be destroyed or removed through extraneous influences, the attachment of the ovum to the wall of the uterus fails.

Aschoff has shown that the ovum leaves the follicle without a trace of hæmorrhage, and that the follicle grows and reaches its greatest development in about 14 days after ovulation; but that only coincidently with the uterine bleeding does the characteristic hæmorrhage take place in the follicle which initiates its degeneration. He has shown that this hæmorrhage comes from the rich capillary system of the layer of granulosa lutein cells. The inhibitory function ceases when the regressive changes initiated by the hæmorrhage are well advanced, toward the end of the third stage, or 14 days after the hæmorrhage has taken place into the follicle. And then another follicle ruptures.

It is therefore obvious that if the menstrual hæmorrhage should not take place in the follicle, because of, let us say, a defective formation of the capillary system in the layer of granulosa lutein cells; or even if the hæmorrhage does occur, should the chemical changes which produce the marked degeneration of the lutein cells not take place, the follicle will follow the course of the corpus luteum of pregnancy. It remains in the blossoming state, at the height of its lutein secretory activity. The retrogression of the follicle is delayed, an inhibitory effect is exercised on further follicle rupture, and ovulation and uterine menstruation are absent.

The action of the radiation may be to produce degenerative changes in the corpus luteum which in 14 days will result in sufficient involution of the corpus to permit a new ovulation and the concomitant premenstrual swelling of the uterine mucous membrane which in 14 days after ovulation will result in menstruation. Thus, the whole cycle of changes would take place in 28 days. In the majority of cases, menstruation followed the treatment in 28 to 30 days. This result is quite in accord with the changes produced by radiation on tissues in general. The endothelium of the finer blood vessels is extremely sensitive to the radiation. Occlusion of the smaller vessels with anæmic infarction is one of the first changes to be noted, and the highly vascular capillary system of the layer of granulosa lutein cells could be thus quickly affected.[1]

The effect of radiation on the graafian follicle. If, as a result of intrinsic or extrinsic causes,[2] the new follicular rupture is delayed[3] or does not occur at all in spite of the fact that the degeneration of the last corpus follicularis so necessary to menstruation has taken place, it is conceivable that the irradiation may aid the rupture of a mature graafian follicle or produce changes biologically equivalent to a rupture. The irradiation which produces this result must, however, at the same time injure the ovum which undoubtedly dies; for the difference in sensitivity cannot be so great that the expelled ovum would be left unaffected. As a result of such changes, the premenstrual uterine phenomena are incited. Frank states that at the time of follicular rupture, a concentrated active extract (the follicle fluid) is poured out and is rapidly absorbed by the lymphatics. The granulosa of the follicle at this time has no connection with the blood stream; but immediately after ovulation, capillaries penetrate the ruptured follicle and within a few hours the process of vascularization places each secreting cell in intimate contact with one or more capillaries.

The process once started, the corpus follicularis undergoes its degenerative changes and

[1] Rohdenburg has shown that premature hyalinization of the vascular supply of the corpus luteum impedes the recession of the corpus follicularis. The detritus of the lutein cells is not completely and promptly removed.

[2] In approaching the peritoneal epithelium through which the rupture occurs, the follicle must push aside or distend the connective tissue of the tunica albuginea. Ordinarily this is a weak layer, but in some cases it is more highly developed, and it has been suggested that it may act as an obstruction to ovulation.

[3] Such cases may have periods of metrorrhagia or menorrhagia with a history of amenorrhœa.

the cycle is continued. Under these circumstances, the menstruation should take place at the end of 14 to 15 days after treatment. This it does in some cases.

The effect of radiation may be the result of hormone production from the ovarian stroma or from other pelvic structures.

Through the action of the radiation on the ovarian stroma (interstitial cells), a hormone may be released which directly, or indirectly through action on other glands of internal secretion, controls ovulation, and pregravid changes in the sex organs.

It is claimed that these interstitial cells are normally found within the stroma of the cortex. They resemble lutein cells but are smaller. They have been compared to the interstitial cells of Lydig. They are not homologous according to Jaffe and Marine and are believed to contain secreting granules. They are apparently derived from the theca interna of the atresic follicles.

Steinach and Holzknecht irradiated the ovaries of young guinea pigs, and found on histological examination an accelerated destruction of the ova with atresia of the follicles and with this more or less complete atrophy of the follicles, both young and mature. There was an associated proliferation of the cells of the theca interna, called by them the interstitial cells. Associated with these histological changes there was not an atrophy, but a marked hypertrophy of the uterus and acceleration of the development of the sex markings. It was held by them that these uterine changes were evidently the result of hormonal irritation from the markedly proliferated interstitial cells as well as from the direct effect on the uterine tissue.

Geller, however, irradiated rabbits with moderate dosage and observed no alterations in the secondary sex characters. Likewise the hypophysis showed no histological changes referable to the treatment.

If the proliferation of the so-called interstitial cells does take place it is an extremely transitory phenomena for degeneration rapidly follows if the ovary is left *in situ*.

A theory has been expressed that the protein products resulting from the breaking down of the lymphatic tissues of the pelvis may act as an activating agent to the female sex hormone (Frank) present at times in the circulating blood.

Sippel transplanted the ovarian fragments from other women into the abdomens of sterile women with insufficient menstruation and with amenorrhœa. All began to menstruate regularly and three of them conceived. Such a graft stimulates the hypofunctioning ovaries to activity.

There is a close interrelationship between action of the thyroid, thymus, adrenals, hypophysis, and the ovary. In fact, substances released, for instance, by radiation of any part of the body can effectually influence the sexual organs as shown by the experiments of Poos. Genital hormones may be influenced by radiation of the spleen, or the lymph tissue of the parotid gland (Amreich). Spiethoff having observed a return of menstruation when the spleen was irradiated for cutaneous affection, applied the X-ray over the spleen in patients suffering from amenorrhœa, and reports several successes. He sees no other explanation of this result except that of intervention of a splenic hormone in ovarian action. A small dose of radiation applied to the thyroid in hyperthyroidism with amenorrhœa will produce menstruation. On the other hand, Holbauer believes the follicular liquid, when the follicle bursts, produces pituitary changes, acting as a sensitizer—an activator. He points out that modifications of the genital apparatus from other sources have their influence through the pituitary gland. An example of this is the pituitary hypertrophy in pregnancy which is due to parenteral absorption of heterogenous albumins which may be to some extent of placental origin, because hypertrophy is experimentally produced also by injection of placental extract and of peptone. It is also produced by the injection of ovarian extracts. Moreover, he regards the anterior pituitary and the hypothalamus as intimately concerned in the mechanism of ovulation and as possessing a controlling importance in regard to menstruation, because he has observed suppression of ovulation in animals when the anterior pituitary lobe was removed and its precipitation by injections of pituitary extracts. The climacteric symptoms after roentgen castration may

be alleviated by irradiation of the hypophysis (Borak).

The effect of radiation on the uterine mucosa. In the causation of hypomenorrhœa, the ovary is not alone. The uterus may also play a part. Thus even with a normal ovum and corpus luteum, though the periodicity of the ovarian function is maintained, there may be menstrual deficiency if the uterus is small or defective in development.

It is essential that the mucosa lining the uterus be anatomically capable of responding to impulses arising from the ovary. It is conceivable that if the uterine mucosa is not in such a state the radiation may induce such changes directly. Congestion of the endometrium can be demonstrated after irradiation. This cannot be entirely ruled out as a contributing factor in the production of the results.

SUMMARY

The results of radiation treatment led to the conclusion that a certain dosage in carefully selected cases is capable of producing improvement in ovarian function as shown by the regulation of the menstruation and the induction of pregnancy with the birth of healthy children.

There cannot be any objection to this form of treatment on grounds that the already diminished ovarian activity can still further be diminished by the small doses of radiation. If the condition of the ovary is such that this should actually take place, nothing is lost for such an ovary is incompetent to produce the menstrual mechanism or to produce an ovum capable of fecundation.

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CLINICAL SURGERY

FROM THE CLINIC OF THE INDUSTRIAL HOSPITAL OF SERPOUHOFF

ILIO-ABDOMINAL AMPUTATION IN A CASE OF SARCOMA; RECOVERY; PREGNANCY AND BIRTH OF LIVING CHILD

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IT IS now more than 37 years since Billroth performed the first operation to remove half of the pelvis together with the lower limb and yet the number of reported cases is still very small. As the accompanying table shows, so far only about 70 cases have been reported. A study of this table will readily reveal why the operation is seldom done in surgical practice. The mortality is so great and the end-results so poor that we question whether the operation should be performed or be classed with such operations as the radical removal of cancer of the lower part of the œsophagus. Our case, however, is proof that in some instances at least the operation may give very good results.

ANÆSTHESIA

For such an extensive operation, local anæsthesia is hardly feasible. General anæsthesia has been used in most of the reported cases, but it is true that it does not hold the last place in the list of causes of death. The idea of using spinal anæsthesia, I think, should be credited to Bier, who used it in his case. Since then many others have used it; in our review we find that spinal anæsthesia was used in 8 cases. From my own experience and as shown in the reports of others, I believe that it is the best method in these cases. Trauma is so great and so much tissue is cut asunder that a most profound nerve block is necessary to prevent dangerous shock. During the entire operation the patient must be kept deeply narcotized, and it would be impossible to do this if general anæsthesia were used because the operation requires so much time. Spinal anæsthesia does not have a bad effect on the general condition of the patient but it does produce a satisfactory nerve block and it removes the possibility of shock.

THE EXTENT AND CHARACTER OF THE TRAUMA

Disarticulation of the bony pelvic ring is done in front through the symphysis and in the back through the sacro-iliac synchrondrosis. These points of separation, however, are not definitely fixed. It is not absolutely necessary to cut asunder the cartilage of the symphysis, because if the swelling has reached this point the patient should not be operated upon as the urinary bladder is so close by. If the swelling has not reached this point it is better to file the bone laterally and care should be used not to injure the place of insertion of the rectus abdominis muscle and the corpora cavernosa of the penis or clitoris which if cut may cause a very unpleasant hæmorrhage. One must not separate the ilium from the sacrum at the back unless there is special need to do so. If the swelling has reached the synchrondrosis, it is impossible to reach the large blood vessels for preliminary ligature because the common iliac artery divides just on a level with the synchrondrosis. If the large vessels cannot be ligated it is impossible to operate. But if in the preliminary ligation of the vessels we find that the swelling has not reached the edge of the sacrum, instead of severing the pelvis in the synchrondrosis it is necessary to file with a wire file the ilium from the sciatic notch upward, parallel to the edge of the sacrum and at a distance from the latter of 1.5 to 2 centi-

meters. We thus diminish the trauma greatly, which is essential. We must not use hammer or chisel but a wire file.

The second great step in the operation is the cutting of the sacral nerve plexus. Only a complete nerve block will prevent shock at the moment when the stem or roots of the great sciatic nerve are cut, and for that part of the operation many authors demand deep narcosis. Sometimes even this is not enough and the patients react badly when the section is made. I will cite a few instances from unpublished cases. Dr. V. Rosanov's first patient suffered a severe shock with falling of the pulse at this stage of the operation. An injection of four syringes of camphorated oil improved the pulse enough to continue the operation, but the condition of shock returned during section of the nerves and the patient died 6 hours after the operation in spite of different means of stimulation. Dr. v. Krassintzev in operating upon his fourth case under general anæsthesia observed shock the moment the sacral nerve plexus was cut and in spite of every means to stimulate the patient, death occurred 5 hours after operation.

To prevent such possibilities the injection of a solution of cocaine or novocain into the open severed roots above the line of incision is recommended. It is not difficult to do this during operation, and of course it should be done. Great hopes were laid that with the use of spinal anæsthesia the block of the roots inside the cerebral membrane would remove the reflex during the cutting of nerves on the periphery. Theoretically this result is obviously possible but in practice it does not work out so satisfactorily. Dr. G. Kokin in operating upon his patients under spinal anæsthesia (tropocain 0.10), as a further precaution did not inject the anæsthetic solution into the bared roots. As a result immediately after cutting the sciatic nerve the patient, who until this time felt very well, suffered a severe shock. The pulse was almost imperceptible and although, thanks to the different stimulating injections, the operation could be finished, it was impossible to improve the pulse, and the patient died in 18 hours. In his fifth case Dr. Krassintzev, operating under spinal anæsthesia, injected into the bared roots before section 10 per cent novocain and was successful, as the patient continued in good condition.

In our case, however, even a double nerve block did not fully remove the reflex. We used spinal anæsthesia and the anæsthesia was ideal. Before cutting we injected into each of the large roots 1 cubic centimeter 1 per cent cocaine and after waiting 5 minutes cut the roots, two of them at first and after another 10 minutes, again two. Each time we noticed a considerable fall of blood pressure and the pulse became much faster. These facts emphasize the importance of producing a complete nerve block in these regions.

STEPS TO LESSEN BLOOD LOSS

We must take care to lessen the loss of blood (1) by freeing the limb to be amputated of as much blood as possible before operation, and (2) by preventing as far as possible the loss of blood when the vessels are cut during the operation itself.

To deprive the limb of blood before amputation, one may either elevate the leg or may apply an elastic bandage from the periphery to the center. Such measures are simple, and there is no reason why they should not be used. There is also another way which was proposed by Professor Oppel by which the parts which cannot be bandaged may be deprived of blood. If, during the process of operating, we ligate first only one principal leading artery, the vein not ligated will suck out pretty energetically the blood from the limb. Thus a considerable quantity of the remaining blood will return to the organism and will be *whole*. For example, by temporarily preserving the splenic vein after ligating the splenic artery during removal of the large spleen one can greatly lessen the size of the organ to be removed through cutting off the blood supply. These methods have been tried on extremities; for instance, in the Saratov clinic, Professor Razoumovski uses them in doing an amputation at the shoulder (amputatio interscapulothoracica). For removal of half of the pelvis with the lower limb, Oppel's principle has been used in the clinic of Professor Mirotvorzev, of Saratov, and its use has been fully justified.

We believe that if one ligates first only one external iliac artery, the temporarily remain-

ing vein will suck out a sufficient quantity of blood from the limb to be removed. As to the loss of blood from the cut vessels, we believe that this is considered by the surgeon the most hazardous part of the operation. The size of the flap is so great and so many vessels are cut that one is fully justified in expecting great loss of blood. The apprehensions have been the means of adopting two heroic preliminary measures: the ligation of the common iliac artery and pressure on the abdominal aorta with an elastic band following Momburg's method.

From the experience of some surgeons, who have used the Momburg elastic band, one infers that this operation can be done without loss of blood, but this is true doubtless only while the aorta is being pressed by the elastic band. After the band is removed the hæmorrhage will depend upon what vessels have been ligated; if we have ligated the common iliac vessels, we cannot have great loss of blood, as there is no place from which the blood can come—so why use the elastic band? If only the external iliac artery has been ligated, the flap which receives its blood from the branches of the hypogastric artery may cause a great flow of blood after the elastic band has been taken off before we can stop it.

It is also a well known fact that placing an elastic band in the region of the aorta provokes a considerable elevation of blood pressure, and when the band is removed there is a violent fall in blood pressure which may lead to collapse. The case of Axhausen was an eloquent example of this condition, as the pulse of the patient was practically imperceptible immediately after the band was taken off and she died 9 hours after the operation. Altogether we think that in such a major operation as an ilio-abdominal amputation one must be as careful as possible not to throw an extra burden on the patient's heart such as we would do if we used the elastic band over the region supplied by one of the main arteries.

The above mentioned method of ligating the common iliac vessels has been tried several times but there is always the risk of killing the flap. Professor Brzovski, in a report of 26 cases from the literature of operations done by ligating the vessels (general or both the principal branches), found that of the patients who survived the first 24 hours, in 5 the necrosis of the flap was noticed and that all 5 patients died. In the last case brought to our attention by Dr. Krassintzev and demonstrated at the surgical society meeting in Moscow in December, 1925, the flap had become partially necrotic after the common iliac vessels were ligated. This necessitated several complementary plastic operations, but the patient happily survived.

And so we have before us the problem of securing a good muscular flap without great loss of blood, at the same time keeping the aorta free from pressure and not ligating the hypogastric artery. After removal of half of the pelvis the wounds produced in most cases will be similar—in front the end of the filed os pubis; on top, the edges of the oblique abdominal muscle; and at the back, the filed piece of the pelvis parallel to the border of the os sacrum—so that it will be necessary in closing the wound to use the exterior back flap of the gluteus. We must include the great gluteus to prevent prolapse of the intestines. We must therefore determine how to make this gluteal flap so that it will be properly nourished and at the same time avoid a great loss of blood.

We start dissecting the flap at the posterior angle of the incision which was made in order to ligate the large blood vessels within the pelvis. Beginning at the symphysis pubis we continue the dissection parallel with Poupart's ligament as far as the anterior superior spine cutting off all the muscles from the crest of the ilium to the edge of the sacrum. From here the flap is cut, first parallel to, and including, the upper edge of the great gluteal muscle, then downward in a curve toward the greater trochanter. From here we curve again downward and backward toward the gluteal fold. After this it is necessary to dissect the intermuscular tissue and to divide the great and middle gluteal muscles, as in them is located the stem and principal branches of both gluteal arteries. It is best to proceed from the great trochanter along the top of the great gluteal muscle. When traction is exerted on this muscle toward the rear we meet a resistance from the front exterior fastening of the muscle to the iliotibial tract. Following the

direction of the skin dissection, we begin to cut away the muscle from the aponeurosis, all the time pushing the flap toward the back and proceeding in the slit between the muscles. The incision must be large enough to allow us to separate the big and middle gluteus muscles and to work between them to the ischiatic opening. When the muscle is cut in front, some ends of the branches of the superior and inferior gluteal arteries get into the slit. These vessels are cut away gradually and bleed but little.

But when the intermuscular space is well opened up, we are masters of the situation in that there is a slight possibility of certain hæmostasis. Both gluteal arteries come out of the pelvis through the large sciatic opening and divide into two branches by the pyriform muscle. The form and course of this muscle are very characteristic and assist greatly in orientation and establishing the topographical relations of the vessels and nerves. Through the foramen suprapyriformis the superior gluteal artery and nerve emerge from the pelvis; through the lower foramen the lower inferior gluteal artery and nerve, the sciatic nerve, the posterior femoral cutaneous nerve, and the internal pudendal artery. This last has no relation to the flap because emerging through the foramen infrapyriformis it goes back into the pelvis through the lesser sciatic foramen.

All the principal vessels of both the gluteal arteries which concern us branch off the main artery in the muscular slit described. This makes it possible for us to ligate with ease all the principal branches which supply the region which is to be cut off. The superior gluteal artery having a very short stem (0.5 to 1 centimeter long), divides immediately into two branches, the superficial and the deep. The first supplies blood to the large gluteal muscle and to the skin covering it; the second (often double) nourishes the middle and lesser gluteal muscles. The deep branch and one or two branches of the superficial vessels are ligated. The stem itself and the superficial branch are of course well taken care of. Besides, all the lower part of the great gluteal muscle with the skin covering it is supplied by the lower gluteal artery. The latter coming from under the edge of the pyriform muscle does not divide at the top into branches but for the most part continues as a main stem to the interior surface of the great gluteal muscle, following all the time the mentioned intermuscular slit. Its stem is easily seen during its course and one can easily ligate a few branches leading to the middle gluteal muscle. If the end of the artery has not been cut previously, one must place a ligature on the stem if the point of insertion of the muscle to the thigh bone has not been reached.

After the artery is ligated one may dissect all the great gluteal muscle from the thigh almost without loss of blood. We have now practically finished dissecting the flap which can be retracted so that the whole field of operation in the region of the ischiatic foramen is exposed. The pyriform muscle is cut asunder and the middle gluteal muscle is separated from the bone. Hæmostasis is secured by ligating the superior gluteal branch. The sacral plexus is bared, anæsthetized, and cut. A wire file is placed in the sciatic foramen and the pelvis is filed from bottom to top, parallel to the edge of the sacrum.

As the pelvis in the region of the symphysis has been filed at the beginning of the operation, the entire half of the pelvis becomes movable. We have cut only the thick sacrospinous ligaments and sacrotuberosum, the iliopsoas muscle, and the levator ani. The slitting of the iliopsoas muscle is possible after traction, after which the part to be cut off is held only by the fibers of the muscles at the bottom of the pelvis. These are cut away along their fastening to the pubis and ischium. Only a few branches of the internal pudendal artery are affected if its stem had not been ligated simultaneously with the branches of the gluteal artery on the level with the incisuræ ischiadicæ. Before the final detachment of the pelvis, one must remember the obturator artery for if the latter has not been ligated at the beginning of the operation it should be ligated now. Of course we must take care not to involve the obturator nerve in the ligature.

This method was used in our case.

A peasant, aged 36 years, came to the surgical department of our hospital because of swelling in the right groin and pain in the calves and knee. In her

childhood she had always been well. Her family history is negative. She denies lues. The Wassermann was 4 plus. She has had 8 children and 7 of them are still alive. A year previously she had been in another hospital for treatment of typhus exanthematicus and soon after convalescence she noticed for the first time a swelling in her right groin. At the first examination, June 6, 1923, a compact tumor was found occupying the right part of the right inguinal region and the top third of the thigh. This swelling was quite immovable and there was no doubt that it was a neoplasm. Because the roentgen cabinet was out of order the patient was requested to return in a fortnight for X-ray examination. She did not come back, however, for 3 months and when she entered the hospital she could not walk on her foot and moved about on crutches. The tumor by this time had increased in size and presented the form of a cone, with top down, about 25 centimeters below the anterior superior spine and the base was almost on a level with Poupart's ligament. In front the growth had obviously permeated the muscles of the thigh while the back and sides of the thigh were free from the growth. The femoral artery coming from the lacunæ vasorum could be well felt for a distance of 4 or 5 centimeters lying straight on the swelling; lower down it could not be felt on palpation. At the side in the gluteal region, over the crest of the ilium and Poupart's ligament enlarged veins were clearly visible under the skin. The whole foot was in the position of adduction and inward rotation and passively kept this forced position.

Roentgenographic examination showed no normal outline of the upper part of the thigh, as the outside of the femur, trochanter muscle, and all the upper part of the neck of the thigh were absent. These parts were hidden by the shadows which the swelling produced, the form and length of which could be distinguished on the roentgenogram among the other soft parts of the thigh. One could see that the swelling arising from the great trochanteric muscle and upper part of the neck of the femur extended inward to the head of the femur destroying the most of it. Of the head there remained only a line in the form of a crescent corresponding to the lower middle segment. The swelling came so near to the lower part of the neck that the bone had broken near the trochanter and a coxa vara had been produced.

Operation was performed October 23, 1923, under spinal anæsthesia, 2 cubic centimeters of 5 per cent novocain. During the whole operation, the anæsthesia was perfect. The patient talked, drank, and said she felt no pain whatever. The successive steps of the operation were as follows: An incision was made extending from the symphysis parallel with Poupart's ligament to the anterior superior spine, then along the crest of the ilium to the synchondrosis, cutting away all the muscles. With such a large incision it was easy to exfoliate the peritoneum with the ureter and ligate the external iliac artery below the point at which it deviates from the hypogastric artery. Then with a gigli file we filed the pelvic ring in front, laterally from the symphysis a distance of 1.5 to 2 centimeters. We cut the gluteal flap as described. The pelvis at the back was filed with the gigli file and the thick sacral ligament dissected. The muscles of the bottom of the pelvis were cut and it was now possible to remove half of the pelvis. The loss of blood during the entire time was very little. The edges of the great gluteal muscle were sewed to the lower ends of the oblique abdominal muscles as well as the muscles at the bottom of the pelvis. The flap covered the whole wound beautifully and the wound was closed without strain upon the sutures. Two rubber drains were placed in the corners.

The after course was uneventful and the wound healed per primam. The patient has a good muscle barrier and no projections are noticed. When in May, 1924, I demonstrated at the XVI Reunion of Russian Surgeons, the patient and the specimen of the removed limb which on histological examination showed chondrosarcoma, I did not know then what a serious test the gluteal flap was destined to have. The fact is that 2 months after the reunion, my patient came to be examined and we found that she was pregnant 4 months or more. Of course I was greatly perplexed at the idea of the coming childbirth in such unusual conditions—the absence of one-half of the bony pelvis and the defect covered with a plastic muscular flap. I consulted many experienced accoucheurs as I wished to know what difficulties were to be expected during the labor. I was told that even in case of a normal presentation of the head, as there would be no guiding support from the pelvic ring, the head might follow the line of least resistance, that is, sideways toward the defective side of the pelvis. The child would then either pass into a lateral position or become firmly fixed with the head in the side wall of the uterus in the direction of the operative scar.

Of course these were all theoretic conjectures, because not one of the accoucheurs had ever met with practically such a case. I decided to take the patient into my surgical department for delivery with the idea of doing a cæsarean section if necessary. The patient timed very accurately the time for delivery and arrived 4 days before time. The roentgenogram showed the head in normal position, the back to the left. The pains began very normally and in a half hour the patient gave birth to a son weighing 4,200 grams. The placenta was expelled 30 minutes later. There was no great loss of blood. The puerperium was uneventful and mother and child went home on the seventh day.

I saw the patient last in October, 1925. A letter from her later states that she was quite well and has stopped nursing the child. During childbirth and when last examined, the operative scar was perfect, the muscle holding tight the abdominal contents not causing her any discomfort. In the roentgenogram we could see a considerable curving of the remaining half of the pelvis at the cost of an extension of the left synchrondrosis; the symphysis is not

Fig. 1. Photograph of patient after operation.

in the middle line, but has moved to the left 7 to 10 degrees. The explanation of this is not difficult to find when we consider the unusual circumstances.

The results of operation can best be determined by looking at the tables. Such reviews have been made before (Kulenkampff, Ransohoff). Of late years the Russian authors Veinschal and Brojosovski have analyzed the literature in detail, bringing it to date by adding the recent cases. These two authors studied the reports of 43 cases. Brojosovski divided the material into groups according to the character of the illness of the patient, age

Fig. 2. Photograph of patient with child.

and sex, and based the mortality percentages on the length of the time from operation, independent of the cause of death. He found that early death in cases of sarcoma occurred in 66.6 per cent; in cases of tuberculosis and osteomyelitis in 50 per cent. The general mortality was 62.8 per cent.

If we do not include the malignant neoplasms about which we do not personally share the opinion of Kocher, namely: "in the presence of tuberculosis of the pelvis in which such a major operation is indicated . . . . even in cases in which the hip is also affected, resection of the pelvis can be combined with the resection of the hip joint," even then the results of the operation in cases of sarcoma remain till now overwhelmingly poor. Brjosovski could show only one case, that of Freeman, that could be counted more or less satisfactorily cured, because in the cases of Salischev and Pagenstecher the patients were kept track of for only 2 or 3 months after operation.

To our great sorrow our review darkens the statistics rather than improves them because the last case has been followed for only a short time and our good result and favorable convalescence is offset by the large number of deaths either immediately after operation or as a result of a relapse or metastasis soon after leaving the hospital. But from relapses and metastasis no patient with sarcoma is guaranteed and with the progress which has been shown in the technique of operation—spinal anæsthesia, nerve block, the ligation of vessels of the flap on extension—one may perhaps be able to improve the early results and there is no reason to refuse these patients the last, perhaps a desperate, chance to save their lives. I trust that my case will encourage the hesitating.

TABLE I. CASES OF ILIO-ABDOMINAL AMPUTATION

No.	Author	Where published	Sex	Age	Cause of operation	Anæsthesia	Duration of operation	Result of operation Notes
1	Billroth (1889)	Cit. by Girard; Kulenkampff communicates from the words of Prof. Berg, Stockholm	M		Sarcoma			Death soon after operation from shock.
2	Jaboulay (1894)	Lyon méd., 1894, xv, 4	M	66	Sarcoma femoris	Narcosis	1 h.	Death next day. Sepsis.
3	Jaboulay (1894)	Cit. by Girard	F		Sarcoma pelvis			Death in 5 days. Sepsis.
4	Cacciopoli (1894)	Riv. med., vol. ii	M	17	Sarcoma femoris			Death in 3 hours.
5	Girard (1894)	IX Congres franç. de chir.	F	17	Sarcoma femoris et pelvis	Narcosis		Death; in a year's time after disarticulation of thigh. Recidive, then E. S. A. again recidive, in 6 months. Death in 50 minutes. Shock.
6	Girard (1895)	Rev. de chir., vol. xxvi, 365	M	15	Tuberculosis femoris et pelvis			
7	Girard (1898)	XII Congr. franç. de chirurg. Rev. de chir., p. 1141	M	52	Sarcoma femoris et pelvis			Convalescence. Death in 6 months from metastasis in lungs.
8	Bardeucheur (1897)	Zentralbl. f. Chir., 1897	F	46	Tuberculosis	Narcosis	1 h.	Convalescence.
9	Bardeucheur (1897)	Look Zesass, Z. f. orthop.						
10	Bardeucheur (1897)	Chir., cit. by P. Tichov						
11	Bardeucheur (1897)	"Tuberculosis of Joints and Bones," p. 431, Tomsk, 1909						
12	Salitchev	Vratch, 1899, No. 25-25. (Russian)	M	38	Sarcoma femoris	Narcosis	1 h. 25 m.	Convalescence.
13	Faure	Rev. de gynéc., 1899. Cit. by Kulenkampff Rev. de chir., vol. xxvi, p. 365. Cit. by Ransohoff	F	16	Sarcoma pelvis			Operation not finished because of great loss of blood; death.
14	Kadian (1900)	Ann. Russian surg., 1900	M	25	Sarcoma femoris	Ether	1 h. 5 m.	Death in 2 days. Shock.
15	Nanu (1900)	Rev. de chir., 1900	M	50	Sarcoma ossis ilii	Ether	1 h. 15 m.	
16	Gouet (1895)	Prov. méd., 1895, No. 54					1 h.	Death in 36 hours.
17	Freeman (1899)	Ann. Surg., xxxii, p. 318	F	38	Sarcoma femoris			Convalescence. 16 months well.
18	Kocher (1898)	Cit. by Kulenkampff	M		Sarcoma pelvis			Death.
19	Kocher (1902)	Chirg. Operationslehre, also Jahresb. f. Chir., 1902, p. 603. Cit. by Ransohoff			Sarcoma pelvis			Death from collapse on the second day.
20	Orloff (1901)	Messenger of Surgery (Russian), 1901, No. ii	M	47	Sarcoma femoris et pelvis			Death in a month from diarrhœa and late hæmorrhage.
21	Michailov	Surgery, 1902, v. xi (Russian)	M	17	Tuberculosis	Chloroform + ether	35 m.	Death in 45 minutes.
22	Morestin (1902)	Arch. gén. d. méd., 1903; Bull. et mém. Soc. anat. de Par., 1902, iv, 68.	F		Sarcoma pelvis		50 m.	Death on the same day.
23	Savariaud (1901)	Rev. de chir., 1902, xxvi, 360		7	Sarcoma pelvis		1 h. 20 m.	Death in a few hours.
24	Keen and da Costa	Internat. Clinics, vol. iv, XIII Serie; ref. Zentralbl. f. Chir., 1905, No. 15, 417			Sarcoma pelvis			Death in 33 hours.

No.	Author	Where published	Sex	Age	Cause of operation	Anæsthesia	Duration of operation	Result of operation Notes
25	Sinakevitch (1908)	Surgery, vol. xxvii, p. 60 (Russian)	M	47	Sarcoma femoris et pelvis			Death in a few hours.
26	Krim (Kadian)	Surgery, 1913, xxxiv, 763 (Russian)	F	27	Sarcoma coxæ	Ether	1 h. 15 m.	Death on the thirteenth day.
27	Gallet (1901)	Ann. de la soc. belge dé chir., 1901, p. 569. Cit. by Kulenkampff	M		Tuberculosis			Death in 5 hours.
28	Gallet (1901)		F	30	Sarcoma femoris			Death in the evening same day.
29	De Ruyter Meyer	Dissertation. Leipzig, 1902	F	45	Sarcoma coli femoris			Death in an hour.
30	Dreist	Deutsche Ztschr. f. Chir., lxxi, 34	F	2	Coxitis tuberculosis			Convalescence.
31	Bier (1008)	Deutsche med. Wchnschr., 1909, No. 1, 45	M	45	Sarcoma coxæ	Spinal anæsthesia		Elastic band Momburg. Death on the table.
32	Pagenstecher (1909)	Arch. f. klin. Chir., xc, 160	F	50	Sarcoma coxæ			Elastic band Momburg. Convalescence 3 months —all well.
33	Hogard Prengel (1899)	Lancet, 1909, vol. i, 530		10	Tuberculosis coxæ			Second operation after disarticulation of the thigh. Slow recovery.
34	Hogard Prengel (1906)	Ibidem	F		Tuberculosis pelvis			After disarticulation of thigh—E. Y. A. death the same night from collapse.
35	Hogard Prengel (1909)	Ibidem	M	18	Sarcoma femoris		50 m.	Recid. after disarticulation of thigh—E. Y. A. convalescence. Death from metastasis in 5 months.
36	Axhausen (1910)	Arch. f. klin. Chir., xci, 538	F	45	Sarcoma femoris	Ether		Elastic band Momburg plastic of free transplant. Cristal-tibiæ; death in 9 hours.
37	Loeffler	Muenchen. med. Wchnschr.; cit. by Veinshall	M	11	Sarcoma pelvis			Plastic by Axhausen. Convalescence followed during 15 months.
38	Babcock	Surg., Gynec. & Obst., 1918, xxvi; cit. by Veinshall.						
39	Ransohoff	Ann. Surg., 1909, l, 923	M	45	Sarcoma pelvis	Ether		Death from septic enterocolitis 4 weeks after the operation.
40	Ribbera (Madrid, 1902)	Cit. by Ransohoff			Tuberculosis			Death; collapse.
41	Ribbera (Madrid, 1902)	Luis y Simon Siglo Med., 1903, vol. v			Tuberculosis			Death on the eighth day.
42	Ribbera (Madrid, 1902)				Tuberculosis			Death; collapse.
43	H. Vermeuil (1905)	J. de Chir. Belge ,vol. v, p. 406; cit. by Ransohoff						
44	Veinshall (Finkelstein) 1921, Bakou	New Surg. Arch., v. iii, 147 (Russian)	M	25	Sarcoma pelvis	Narcosis	1 h. 30 m.	Momburg. Death in 23 days. Parotitis, pneumonia.
45 46 47 48 49	Pringle Pringle Pringle Pringle Pringle	Brit. J. Surg., 1916, iv cit. by Veinshall 2 of these cases were cit. by Ransohoff						2 deaths and 3 convalescences.

TABLE I.—CONTINUED

No.	Author	Where published	Sex	Age	Cause of operation	Anæsthesia	Duration of operation	Result of operation Notes
50 51 52 53 54	Bergmann Bergmann Bergmann Bergmann Bergmann	Riga Med. Soc., 1918; cit. by Veinshall			{Osteomyelitis; non-tuberculous			2 deaths and 3 convalescences.
55	Brzosovski (Astrakhan) (1921)	New Surg. Arch., vol. iv, p. 179 (Russian)	F	16	Sarcoma coli femoris	Ether and chloroform	1 h. 15 m.	Convalescence; death from metastasis in the lung in 4 months.
56 57	Czerny Goldberg	Cit. by Brzosovski						
58	Israel (Berlin)	Cit. by Brzosovski	F		Sarcoma			Elastic band Momburg. Death in ½ hour.
59	Laschtaria (1907)	Riforma med. Napoli, vol. v, p. 457. Cit. by Ransohoff and Brzosovski						Death on the table.
60	Krynsky	Przeglad. chir. i. gynek., vol. i, 1; Zentralbl. f. Chir., 1910, v, 1132			Sarcoma femoris et pelvis	Spinal anæsthesia	1 h. 10 m.	Death in 5 weeks; cachexia.
61	Smirnov (Saratov) 1919	Cit. by Brzosovski (Russian)	M	33	Tuberculosis coxæ		2 h.	Death on the table.
62	Toprover-Krimov (Kiev)	Ekaterinoslav Med. J., 1924, No. 1, 2, p. 44 (Russian)	M	47	Sarcoma femoris	Chloroform	2 h.	Death in 2 months from metastasis in lung.
63	Rabinovitch (Saratov)	New Surgery (Russian), 1925, No. 3, p. 374	M	58	Sarcoma femoris	Spinal anæsthesia	1 h. 20 m.	Convalescence. Went home on the 20th day. In five weeks more died with symptoms of violation of psychics and heart failure.
64	Rabinovitch (Saratov)	Ibidem	M	49	Sarcoma femoris	Spinal anæsthesia		On the third day amid good general condition death suddenly (embolism).
65	Judin, S. Serpouhoff U. S. S. R.	16 meeting of Russian Surgeons, p. 697	F	36	Sarcoma coli femoris	Spinal anæsthesia	1 h. 35 m.	Convalescence. Gravidiatas. Childbirth.
66	Kokin, G. Moscow, 1924	Personal communication	F	30	Sarcoma pelvis	Spinal anæsthesia	Less than an hour	Death in 18 hours; collapse (shock when cutting the nerves).
67	Rosanov, V. Moscow, 1906	Personal communication	F	27	Tuberculosis coxæ	Ether + chloroform	1 h. 50 m.	Death in 6 hours after operation (shock when cutting the nerves).
68	Rosanov, V. Moscow, 1907	Personal communication	M	35	Sarcoma ossis ilii	Spinal anæsthesia	1 h. 20 m.	Death in 3 months from metastasis in lung.
69	Rosanov, V. Moscow, 1907	Personal communication.	M	30	Sarcoma	Spinal anæsthesia	1 h. 30 m.	Death on the fifth day from anæmia (great loss of blood during operation).
70	Krassintzev Kalouga	Personal communication	M		Sarcoma femoris	Chloroform		Death in 8 days.
71	Krassintzev Kalouga	Personal communication	M		Sarcoma femoris	Chloroform		Death on the 30th day from infection of wound.
72	Krassintzev Kalouga	Personal communication	M		Sarcoma femoris	Chloroform		Death on second day.
73	Krassintzev Moscow		M	45	Sarcoma pelvis	Chloral		Shock when cutting of plexus sacralis. Death in 5 hours.
74	Krassintzev Moscow	Moscow Surg. Society, xii, 1925	M	43	Chondro Sarcoma femoris	Spinal anæsthesia	1 h. 50 m.	Convalescence.

FROM THE CLINIC OF ALLEN B. KANAVEL AND SUMNER L. KOCH, WESLEY MEMORIAL HOSPITAL, CHICAGO

THE COVERING OF RAW SURFACES WITH PARTICULAR REFERENCE TO THE HAND[1]

BY SUMNER L. KOCH, M.D., CHICAGO

THERE are many sound reasons for covering raw surfaces as promptly as possible with normal tissue. From an economic, from a cosmetic, and most important from a functional standpoint, the repair of defects of the superficial tissues must appeal to the surgeon as of primary importance. When the raw surfaces in question involve parts of the body that are subject to constant movement or whose function depends in great part upon their ability to move freely, the avoidance of scar tissue formation becomes even more imperative.

Scar tissue is the natural enemy of freedom of motion. It develops rapidly; it slowly but constantly undergoes contraction; as it contracts it produces tension upon and compression of the sensory nerves of the affected area. The painful sensations resulting constitute another obstacle to the restoration of the desired freedom of motion.

In determining what method should be applied in covering a given raw surface, two factors are of primary importance: the structures which constitute the raw surface, and the presence or absence of infection. If the raw surface is formed in part by tendons, bone, joints, or by important nerves and blood vessels, a full thickness graft with at least a thin layer of subcutaneous tissue is essential to afford adequate protection of the underlying structures and to prevent the formation of adhesions between structures that should be free to move independently of one another. In the presence of infection, however slight, only a thin graft (Thiersch) or a pedicled flap can be used with assurance of success.

In addition to these primary considerations, other factors should be mentioned. The size of the defect is not in itself an indication for any particular type of graft. Large surfaces can be successfully covered with a free thick graft.[2] One is limited rather by the amount of available tissue than by the size of the defect. The location of the raw surface is important. Grafts to replace defects about the face and forehead should be thick enough to restore the original contour or they may become ugly deformities. The contour of the raw surface must be taken into consideration. Folds and depressions, such as in the axilla or about the neck, are difficult to cover because it is difficult to maintain accurate apposition between the graft and the raw surface. The mobility of the raw surface or the absence of a firm base may prevent the application of sufficient constant pressure to permit the successful use of a free thick graft. Lack of normal tissue in the neighboring area may prevent one from swinging a pedicled flap from the most convenient location and necessitate the use of flaps with long pedicles taken at a distance.

In covering defects of the hand, the use of thick grafts is essential if one would avoid subsequent contraction. Pedicled flaps give the most certain assurance of success, and permit the utilization of subcutaneous tissue. If subcutaneous tissue is still present after resection of the scar tissue, and this happens not uncommonly after the removal of contracted palmar scars, one may use a free thick graft and secure an entirely satisfactory result.

PREPARATION OF THE PATIENT

The patient's general condition is of great importance. One cannot expect healing of a graft in a patient who is septic and losing weight. A high fluid intake, nutritious food, sunshine, fresh air, the quartz light can all be utilized in getting the patient into the best possible physical condition. The effect of daily exposure to the quartz light, for example, on children suffering from badly infected, extensive burns is often surprising.

If the raw surface is infected, every effort should be made to render it as nearly surgically clean as possible. We know of no better method of accomplishing this than by irrigating the wound every 2 hours with properly prepared Dakin's solution.[3] When no organisms or only a few can

[1] Davis (1) suggests that the term thin graft be used to designate Ollier-Thiersch grafts and the true Reverdin graft, and the term thick graft to designate whole thickness or Wolfe-Krause grafts, and small deep grafts. He distinguishes between a graft, which is a mass of tissue cut free from its source and transplanted to a new location, and a flap, which is attached at some portion of its periphery to its original location.

[3] A solution which contains 0.45–.5 per cent sodium hypochlorite which shows no color reaction with powdered phenolphthalein, and which shows only a momentary flash of pink on the addition of alcoholic solution of phenolphthalein.

From the Department of Surgery, Northwestern University Medical School. Presented in part before the Chicago Surgical Society, January 8, 1926

Fig. 1. Repair of an ectropion of the upper lid by means of an Esser epithelial inlay.

be found in stained smears from different parts of the wound, thin grafts may be applied with reasonable assurance of success.

If the part to be grafted is covered with scar tissue, it should be cleansed with warm soapy water on several successive days before operation. If a hand, it should be shaved, the nails should be manicured, and every effort made to free it from bacteria and dead epithelium.

THIN GRAFTS (OLLIER-THIERSCH GRAFTS)

The great advantage of the thin graft lies in the fact that it can be successfully applied over a granulating surface; its disadvantage is that it undergoes contraction and becomes firmly fixed to the underlying tissues. In spite of this disadvantage, thin grafts may often be advantageously used to hasten the healing process in the presence of extensive defects, and prevent long continued suppuration and excessive scar tissue formation, even though subsequent plastic operations with thick grafts may be necessary later. Blair (2) has emphasized this fact with reference to the covering of raw surfaces resulting from burns about the neck and axilla, and Lyle (3) with reference to raw surfaces resulting from injury of the hands.

Fig. 2. Free thick graft over raw surface due to a punch press wound of index finger 24 hours before. The flexor tendon sheath and two distal phalanges were exposed and the distal interphalangeal joint opened at the time of injury. Left, after removal of dressing; right, final result.

Thin grafts are usually secured from the outer and anterior aspect of the thigh or from the arm. If the graft is to be free from hair, the inner aspect of the arm should be used. The site from which the graft is taken is carefully washed with soap and water and alcohol. We do not use iodine in the preparation of the skin from which a thin graft is taken.

Excessive granulations are shaved with a sharp knife from the raw surface to be covered, and pressure is maintained over it until oozing has stopped. The graft is carefully teased out with needles so that no epithelial surface is turned under, and the raw surface is covered as completely as possible with as many strips of epithelium as necessary. Occasionally grafts are sutured in place with a few horsehair sutures, but ordinarily we depend upon the dressing to hold the graft in place.

When the raw surface is covered, a single layer of muslin bandage impregnated with sterile vaseline containing 3 per cent of xeroform (bismuth tribromphenate) is laid smoothly over the grafts. Four or five thicknesses of gauze are laid over this, and over the gauze marine sponges which have been soaked in 1:1000 mercuric chloride, rinsed in sterile water, and wrung dry. A firm pressure bandage binds the sponges in place and maintains an even pressure over the entire surface. When the raw surface covered is small, two layers of gauze are placed over the vaseline gauze, and dental impression compound which has been carefully washed with green soap and softened in hot water is held firmly over the dry gauze until the compound is molded to the underlying surface and has become hard. The dressing is held firmly in place with strips of adhesive tape.

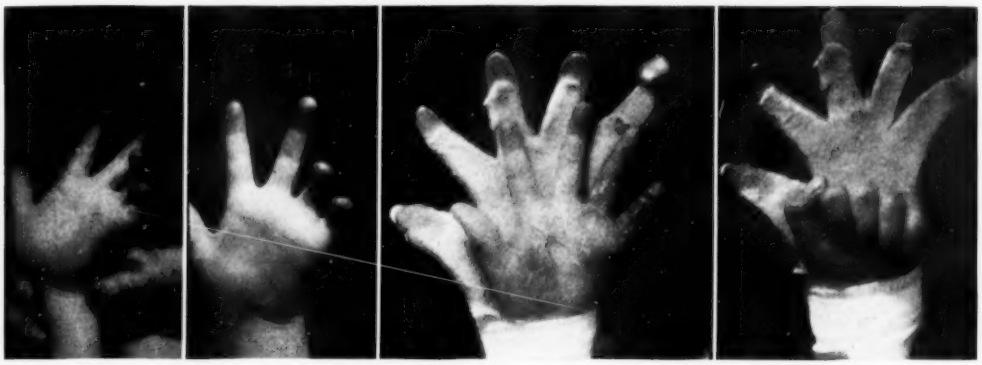

Fig. 3. Free thick graft on palmar surface of fourth and fifth fingers. A small portion of the graft on the fifth finger became necrotic without impairing the ultimate result.

The primary dressing is left untouched for from 5 to 7 days. If the grafts are somewhat macerated at this time and considerable wound secretion is present, dressings are changed daily thereafter and sponge pressure reapplied with each dressing. If the grafts are dry, dressings are changed every third day thereafter, and the pressure and dressing completely removed after from 14 to 16 days.

We have had almost uniformly perfect results with this method in covering fresh raw surfaces, such as are left, for example, after raising a pedicled flap. After covering granulating surfaces with thin grafts, infection has developed in a certain percentage of cases. This has been controlled rapidly in most cases by covering the wound with gauze saturated with Dakin's solution or cold boric solution, reapplying sponge pressure and changing the dressing daily. At the change of dressing, before removing it, the gauze is again saturated with Dakin's or boric to prevent its adhering to the underlying grafts.

No method which we have used in the past—open-air dressing, gutta-percha strips, waxed or paraffin gauze—has given as uniformly successful results as the type of dressing described. We have come to believe with Blair and others, that accurately applied uniform pressure maintained for from 14 to 16 days is the most important factor in the successful after-care of skin grafts.

A more limited field of usefulness for the application of Thiersch grafts is the buried graft or epithelial inlay, according to the method suggested by Esser. This is of particular value in covering surfaces which should be separated but which, by reason of folds or angles and close proximity, tend to become adherent to one another. Wounds at the bucco-alveolar junction and about the orbit in particular can often be effectively covered by means of an epithelial inlay (Fig. 1). In preparing an inlay an accurate model of the cavity is made with softened dental impression compound. A Thiersch graft with the raw surface out is wrapped about the hardened model. A few horsehair sutures may help to hold it in place. The model with the surrounding graft is laid in the cavity and the edges of the defect sutured temporarily to help maintain pressure. At the end of from 10 to 14 days, the sutures are removed, the sutured edges separated, and the impression compound lifted out. The cavity will then be found to be lined with epithelium.

Lastly, thin grafts may be used as a last resort in covering deep defects if full thickness grafts or pedicled flaps are not available or not indicated. A thin graft may be used to cover healthy bone if thicker grafts are not available and if the location is such that the cosmetic result is not of paramount importance.

FREE FULL THICKNESS GRAFTS

There are a number of definite advantages in the use of free thick grafts. They do not undergo contraction as do thin grafts. They retain a certain degree of mobility upon the underlying tissues. They obviate the necessity of keeping the grafted surface in contact with another portion of the body for 2 or 3 weeks. Their use permits one to cover the entire raw surface at the first operation and so prevent infection of a clean raw surface by inoculation with bacteria from the adjacent skin. The disadvantages in their use lie in the fact that no subcutaneous tissue may

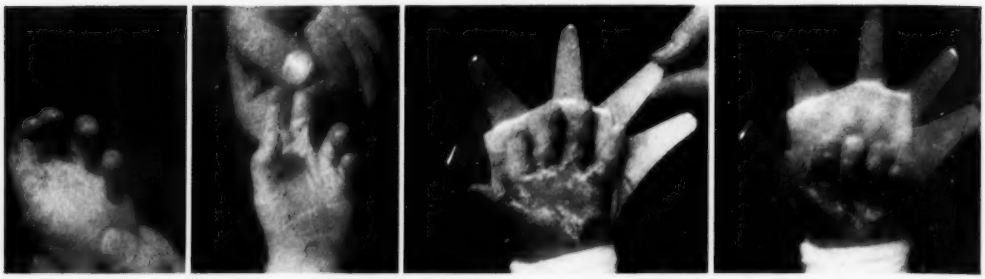

Fig. 4. Free thick graft covering almost all of the palm of the hand.

be transferred with the graft and in the risk involved in depriving a considerable area of skin for a definite period of time of its entire blood supply. The clinical and experimental studies of Blair (2), Neuhof (4), Davis and Traut (5), Ferris Smith (6), McWilliams (7), and others, however, have done much to eliminate uncertainty, and permit the use of free thick grafts with constantly increasing assurance of success.

We have not used free thick grafts on granulating surfaces, although Davis (1), McWilliams and others believe that there is a definite indication for their use under such conditions. In a few cases we have used free thick grafts on raw surfaces resulting from injury 8 to 24 hours previously (Fig. 2), and in each case the graft has been successful. In the great majority of cases, however, thick grafts have been used to cover fresh, raw surfaces left by resection of scar tissue, or raw surfaces left after removal of a pedicled flap of tissue to be used elsewhere.

After the complete excision of scar tissue one is frequently surprised by the extent of retraction of the normal tissues and the size of the resulting defect. Particularly is this true after resection of palmar scars and forced extension of fingers that have been long held in flexion. Unless all the scar tissue is removed, however, and the tissues allowed to retract in every direction, one will be disappointed in the final result. Experienced surgeons indeed turn back the normal skin at the periphery of the defect for ¼ to ½ inch and enlarge by so much the raw surface exposed and the size of the graft (Blair, 2), or undermine the normal skin at the edge of the raw surface for a similar distance and slide the graft underneath it (Davis and Traut, 5). The excess of covering thus provided compensates for the effect of subsequent contraction and subsequent growth, the latter of particular importance when the affected part is a child's hand.

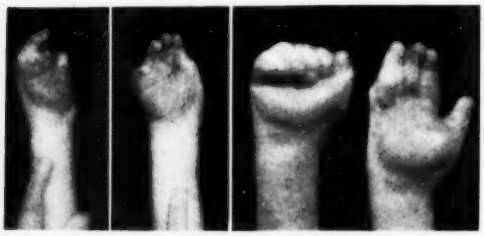

Fig. 5. Pedicled graft so thick that function was not improved in any way. A transverse incision had been made across the graft in the hope that the fingers might be extended by such a maneuver. Treatment consisted in excision of the transverse scar, extension of the fingers with retraction upward of the pedicled flap, excision of excess subcutaneous fat, and application of a free thick graft over the raw surface.

An exact pattern of the raw surface to be covered is made with sterile tin foil, waxed paper, or gutta-percha. A transparent pattern is easier to secure than one of tin foil. The pattern is laid on the thigh or abdomen and outlined with a sharp pointed knife. The graft is raised by keeping it under tension and cutting with a sharp scalpel. If tension is carefully maintained on the graft itself and on the bed from which it is raised, it is possible continually to keep in view the white true skin bare of subcutaneous fat. Securing the graft is the most difficult part of the operation, but with care, a sharp scalpel, and by keeping the white under surface of the skin constantly in view, it is possible to secure a graft free from subcutaneous fat and without perforations.[1]

The graft is sutured accurately in place by anchoring it with a few interrupted horsehair sutures, and then suturing it with a continuous horsehair suture. Before the suture is quite completed a pair of narrow bladed artery forceps is slipped under the graft and a number of small

[1] Tiny perforations are made in the graft after it is sutured in place, but if they occur when the graft is being raised, they may easily be converted by the tension with which the graft must be held into holes of excessive size.

Fig. 6. Free full thickness graft over forehead and reflected portion of forehead flap which is to replace defect of left cheek due to cautery removal of extensive epithelioma. After suturing the graft in place a marine sponge was placed between the forehead and the flap held approximately in the position shown on the left. Other sponges were laid on the graft and the whole bandaged under pressure and left undisturbed for 9 days. When the primary dressing was removed healing was almost perfect.

perforations made with a sharp pointed knife in the skin raised on the open forceps. The perforations permit the escape of blood and serum which may exude from the raw surface on which the graft rests. When the suture is completed, the graft should be under slight tension. If it is relaxed, one must excise a small strip of the graft or draw the sutured edge taut by anchoring it by interrupted sutures to a line parallel to the edge and a few millimeters distant. This method of maintaining tension on the graft, as suggested by Blair, is also used when the edges of the defect have been undermined and turned back in order to increase the raw surface and the size of the graft.

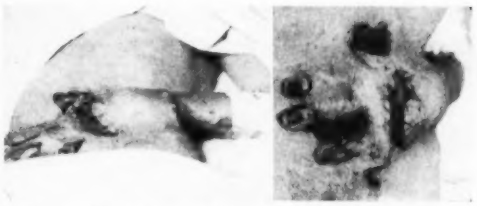

Fig. 7. Hand inserted in pocket flap with fingers protruding from individual incisions.

If the graft has been laid on the palmar surface of the hand or fingers, the hand is strapped upon a prepared splint with the fingers in complete extension (Figs. 3, 4). If the graft is upon the dorsum of the hand, the fingers are flexed over a roll of gauze.

The graft itself is covered with xeroform-vaseline gauze, with several thicknesses of dry gauze, and with marine sponges, and the whole bandaged under firm pressure. Ferris Smith (6) has found that 40 millimeters of mercury is the optimum pressure and suggests the use of flat rubber bags over the dressing, which may be inflated to the optimum pressure. We have not had the opportunity of using this method, but have not had difficulty in cases in which sponges could be applied and bandaged firmly in place. Our difficulty has been with situations like the cheek and the web of the finger, where firm counter pressure was lacking or where it was difficult to apply a bandage firmly. In several cases we have been able to obtain satisfactory counter pressure for the cheek by wiring the jaws and placing

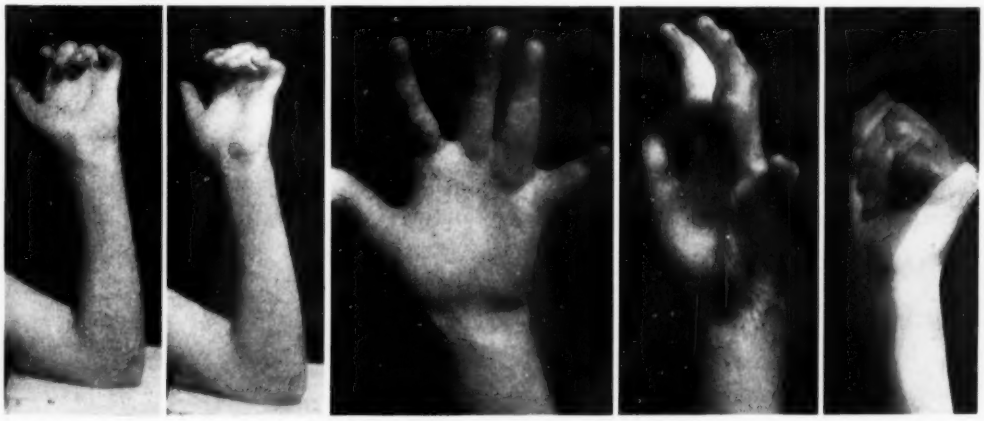

Fig. 8. Repair of a contracted hand by the use of a pedicled flap. Lack of sufficient tissue to reconstruct the web between the middle and ring fingers restricts separation of these fingers.

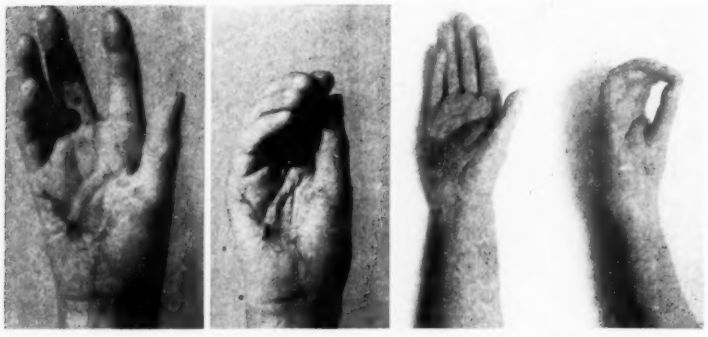

Fig. 9. Repair of a palmar contracture with a pedicled flap. Restoration of the ability to abduct the thumb is an important factor in the functional improvement of the hand.

between the cheek and jaws a previously formed model of dental impression compound. On the forehead (Fig. 6), where the base is firm and smooth and against which one can readily apply pressure, Blair states that he has never had a failure after applying a free full thickness graft. The dressing is completed with as little adhesive tape over the bandage as possible, so that the dressing may not be sealed from the air.

The primary dressing is removed on the ninth day. If any areas of necrosis are present, they are painted with 1 per cent silver nitrate solution. If infection is present, gauze dressings saturated with cold boric solution are substituted for the vaseline gauze, and changed once daily. In all events sponge pressure is maintained for 3 weeks. Not infrequently small areas of superficial epithelium become necrotic, but the deeper layers of the skin remain viable and regeneration of the superficial layer takes place very rapidly. Even if necrosis of the entire thickness of skin takes place over a few small areas, the raw surface is covered rather rapidly by ingrowth from adjacent areas.

PEDICLED FLAPS

The use of the pedicled flap with a single or, still better, with a double pedicle, gives the surest method of covering raw surfaces with a full thickness of skin and in addition permits transfer of subcutaneous tissue with the skin. Its greatest usefulness is in those cases in which loss of superficial tissue has resulted in exposure of deeply lying structures—tendons, joints, etc., which are normally covered by subcutaneous tissue as well as by skin.

The raw surface to be covered must be prepared as carefully as possible so that it may be dry and free from bacteria. If the raw surface is covered with granulations the surrounding area is shaved, carefully scrubbed with soap and water, and finally the raw surface itself is gently washed with soap and water. Excessive granulations are

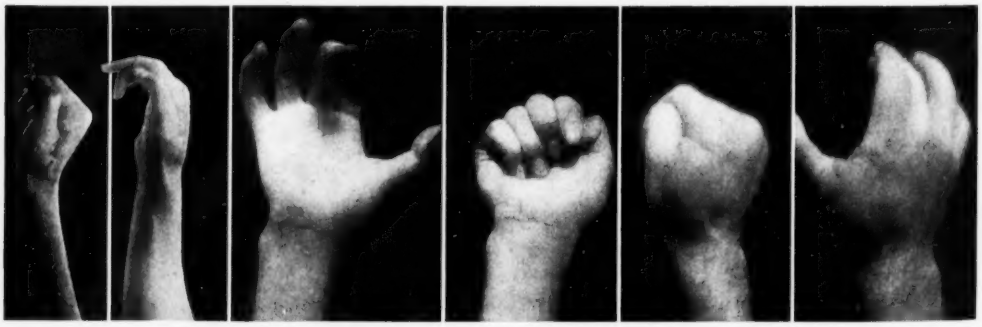

Fig. 10. Repair of a contracture of the hand with a pedicled flap. Note the fixation of the thumb on the left and the degree of abduction possible after operation.

Fig. 11. Repair of a contracture due to a burn of the dorsal surface with the aid of a pedicled flap. The flap was purposely made thicker than usual with the idea of using the excess subcutaneous tissue in a subsequent arthroplasty on the metacarpophalangeal joints. Prolonged physiotherapeutic treatment will probably make this step unnecessary.

shaved off and oozing controlled with hot compresses. If the raw surface has been freshly made by removal of scar tissue, particular care must be paid to hæmostasis. Continued oozing underneath a flap will prevent healing and favor development of infection.

In the preparation of the raw surface, removal of all the scar tissue is necessary if one would secure a satisfactory result. In resecting extensive scars one is often tempted to be conservative, with the result that the edges of the flap are sutured to edges that still contain cicatricial tissue. Invariably such suture lines fail to heal by primary union and the result is imperfect. After all scar tissue is resected, the skin edges bordering the defect should be undermined for some little distance from the raw surface on the sides which are to be sutured to the free edges of the flap, so that the skin may be turned back and broad surfaces apposed to one another. Infolding and subsequent retraction of the scar are thus avoided. The skin edges which are to lie temporarily underneath the pedicles of the flap are not undermined or separated from the raw surface until the flap is completely freed and the final stage of the operation is performed.

In choosing the site for the flap two considerations are of particular importance—the blood supply and the patient's comfort. The graft must lie in such a position that it is assured of an adequate blood supply from definite, known blood vessels. The source of blood supply should be proximal and not distal to the pedicle. The hand, or part to be covered, should be placed in the most comfortable position for the patient. If the dorsal surface is to be covered, the hand is usually placed upon the abdomen; if the palmar surface, over the lumbar region. The position of choice should be determined before the patient is anæsthetized and outlined with brilliant green or an indelible pencil. If possible the skin of the graft should match that of the adjacent surfaces,

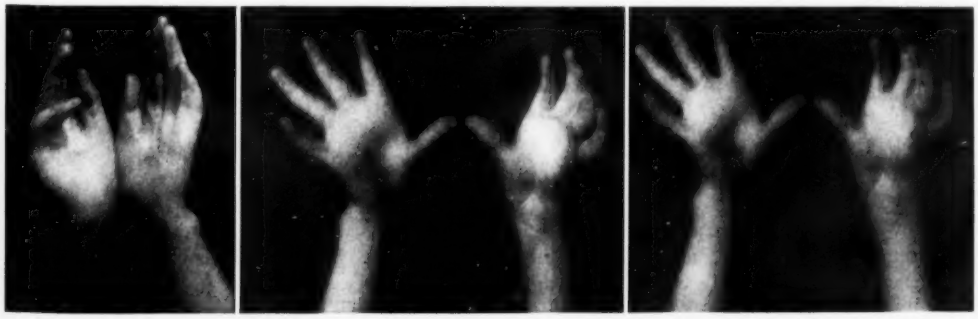

Fig. 12. Repair of burned hands by the substitution of pedicled flaps from the lumbar region for contracted scar tissue.

Fig. 13. Repair of a hand injured in a roller mill by simultaneous dorsal and volar application on clean granulating wounds of single pedicled flaps from the abdomen. Illustrations on the right show the complete restoration of function.

particularly with reference to texture and the presence of hair.

An outline of the flap is made by laying a tin foil pattern of the raw surface over the selected site. The flap itself is cut one-third or one-fourth larger than the pattern to allow for the contraction of the tissues. Ordinarily, we prefer a flap with a double pedicle, with its long axis approximately parallel to the long axis of the body. If one with a single pedicle is used the blood supply must come from above, and the base of the pedicle should be at least one-third wider than the flap itself.

When the raw surface to be covered extends distally upon the fingers, the problem of covering it is more difficult. In such cases a flap is raised by undermining the skin through a single incision parallel to the direction of the main blood vessels. At a suitable distance from this incision individual incisions parallel to the first are made for each of the fingers (Fig. 7). When the flap has been elevated the hand is slipped underneath it as into a pocket, and the portions of the fingers which are covered with normal tissue drawn through their respective openings. In preparing such a flap it is essential that the pattern be prepared with the fingers separated from each other as widely as possible in order that as much tissue as it is possible to secure be available for the reconstruction of the webs of the fingers. Unless this is done one finds in performing the final suture that there is scarcely sufficient tissue to cover the raw surfaces upon the fingers themselves, and no tissue whatever is available to turn down between the fingers for reconstruction of the webs. As a result, separation of the fingers from one another is restricted (Fig. 8).

The flap is raised with as little trauma as possible, and is made to imitate in thickness and in the amount of subcutaneous fat attached to it the tissue which it is intended to replace. Too frequently a large amount of subcutaneous fat is left attached to the skin in the fear that its blood supply may be insufficient, and the final result is an unsightly swelling which offends the patient's sensibilities. In one case which came under our observation (Fig. 5) so much subcutaneous fat was left on a palmar graft that the patient was quite unable to close his hand and function was no better after the operation than before.

To the pedicles of the flap, which are subsequently to be returned to their original position, as much subcutaneous tissue as possible is left attached in order that the blood supply of the flap may be as nearly normal as possible. The pedicles should always be wider than the flap, and must be elevated sufficiently to permit the hand to lie under the flap without producing tension upon it.

After the flap is freed, it is held to one side or lifted in a sling of sterile gauze to protect it from injury while the raw surface underneath is being covered by sliding over it tissue from the sides or laying free grafts upon it. When a flap with two pedicles is raised, we attempt to cover the raw surface immediately by undermining the tissues at the side of the defect and drawing them together by tension sutures underneath the flap. These sutures are left long and the ends gathered into one knot to facilitate removal at the end of 8 or 10 days. The line of suture is covered with xeroform-vaseline gauze to separate it from the warm moist hand overlying it. The same method of closure may be applied if the flap has a single pedicle, or the defect may be partially covered by drawing together the tissues from the sides and covering the raw surface remaining with Thiersch grafts.

Coverings over the raw surface left by raising a "pocket flap," i.e., one which covers both hand

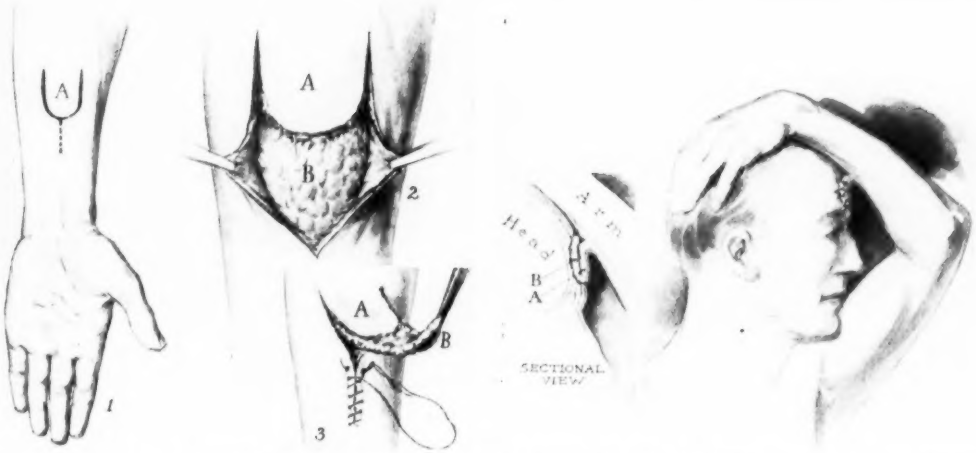

Fig. 14, a and b. Method of securing a thick layer of subcutaneous tissue for filling a defect involving the frontal sinus and overlying tissues. The same principle may be applied in securing a pedicled graft of subcutaneous tissue to insert between the tendons and the bones of the hand or wrist.

and fingers (Fig. 7), offers the greatest difficulty, as there is only one free edge which can be drawn over the raw surface. In a recent case of this type we undermined the free edge, drew it under the hand as far as possible and sutured it to the abdominal fascia. The remaining raw surface was covered with Thiersch grafts as far as one could reach underneath the hand. In this case the Thiersch grafts, held firmly in place by the pressure of the overlying hand, healed perfectly and when the hand was finally separated from the abdomen, the raw surface remaining was only one-third the size of the flap removed. The saving of time and the protection of the raw surface from access of infection more than compensated for the added time and effort spent at the primary operation.

When the raw surface is covered as completely as possible the flap is lifted and the hand wrapped in a thin layer of sterile gauze brought into such a position that the raw surface lies directly under the graft. The free edges of the flap are accurately sutured to the corresponding edges of the hand and a dry dressing applied.

In preparing the hand for the graft we have sometimes found tendons bound so firmly to the underlying bone, that it has been necessary to dissect them free to secure free movement. In such cases we interpose a thin flap of fat underneath the tendons by raising a thicker flap than necessary, and separating from its under surface a thin layer of fat to place between the tendons and the bone. This layer is divided at the middle, and the two halves slipped underneath the tendons, so that each half of the fat flap receives its blood supply from the corresponding pedicle. When a single pedicled flap is used and little subcutaneous tissue is available, a flap of fat may be dissected from underneath the skin just beyond the area of skin which is to be transplanted and doubled back underneath the tendons (as in Fig. 14).

After the operative wound has been dressed the arm must be carefully and firmly immobilzed.

Fig. 15. Technique of repair of the raw surface following a burn of the axilla. The axilla itself was covered by a pedicled flap consisting chiefly of the subcutaneous tissue of the right breast. The under surface of the arm was successfully covered with Thiersch grafts.

Patients may be restless and uncomfortable for 2 or 3 days after operation. The constant tendency is for the patient to push the arm farther through the pocket and put too great tension upon the flap. To obviate this tendency we mold a plaster triangle in the space between the arm and the body to hold the arm firmly from the body at the proper distance. A light body cast is then applied to hold the arm and triangle snugly apposed to the body. The hand and the graft are left freely exposed for daily dressing.

During the first 48 or 72 hours after operation the flap must be watched with particular care. The arm may shift slightly within the cast, or the patient, in his attempt to find a comfortable position, may advance the hand underneath the flap and so put undue tension upon it. In such an event the cast must be changed, or the pedicles of the flap dissected farther back to permit greater relaxation. Death of the flap, or a portion of it, may occur within 24 hours if there is excessive tension with a resulting ischæmia or passive congestion.

For a few days after operation dressings will be saturated with serum oozing from the exposed raw surfaces of the pedicles. Such surfaces should be protected with xeroform—vaseline gauze and the dressings changed each day. If signs of wound infection develop, Carrel-Dakin treatment should be instituted immediately.

At the end of 10 days detachment of the flap is begun. An incision one-half or three-fourth inches in length on each side of both pedicles is made under local anæsthesia. This is repeated every second or third day until the flap is free. Before it is finally detached a rubber band constrictor is wrapped tightly about the remaining portion of the pedicle for one-half hour. If no change of color occurs, the division is completed. If the flap becomes dusky or cyanotic, complete separation is delayed for 24 or 48 hours. In the case of a pocket flap the incisions through which the individual fingers have been passed are first united and then the main pedicles divided as described above.

When the graft is completely separated the hand covered with the graft is bandaged with moderately firm pressure for 24 or 48 hours. No attempt is made to finish suturing it to the hand until time has elapsed for any sloughing that may occur at the edges to take place. Usually at the end of 5 or 6 days, the excess tissue at the edges of the graft may be excised, the skin at the edges of the defect freshened and undermined, and the suture completed. In performing the suture the skin should be undermined sufficiently so that it can be raised and sutured to the free edge of the graft as an ectropion. The line of suture should not form a groove or depression at the edges of the graft.

As soon as possible, even before the flap is completely detached from its pedicle, movements of the fingers should be begun. No one who has not attempted to free tendons which have become adherent to the surrounding tissues will believe how quickly adhesions develop in the neighborhood of an infectious process and in what a vise-like grip they hold the tendons. Fibrous ankylosis of the joints develops with equal rapidity and is quite as effective a barrier to freedom of movement.

SUMMARY

Raw surfaces should be covered as early as possible with normal epithelium to permit healing and prevent impairment of function. Granulating surfaces are best covered with Ollier-Thiersch grafts. Fresh raw surfaces may be covered with free full thickness grafts if sufficient subcutaneous tissue is present on the raw surface. If bones, joints, tendons, or large nerves or blood vessels are exposed in the wound, a covering of both epithelium and subcutaneous tissue is desirable. This may be secured by the use of a pedicled flap.

In any type of skin grafting, cleanliness, asepsis, maintenance of pressure over the graft and conservation of the blood supply are factors essential to success.

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FROM THE SURGICAL CLINIC, BUENOS AIRES UNIVERSITY

THE TECHNIQUE OF IVANISSEVICH'S OPERATION FOR VARICOCELE

By JOSÉ ARCE, M.D., F.A.C.S., Buenos Aires, Argentine

IN the treatment of varicocele we use the operation proposed by Dr. Oscar Ivanissevich in 1918. This operation is based on the idea that varicocele should be considered a disease of the spermatic veins identical with that which affects the saphenous vein in varices; the physiopathology of the two diseases is the same. For this reason Ivanissevich suggests resecting the spermatic vein in the retroperitoneal part of its course when it has left the cord and passes upward in company with the artery, which it is easy to isolate and preserve, just as in varices it is advisable to resect the internal saphenous as high up as possible in order to avoid recurrence.

There is no danger in the operation except for the complications which may arise from infection during operation or from a hæmatoma from incomplete hæmostasis. Embolism resulting from septic thrombosis of the venous stumps has never been observed; injury of the peritoneum is exceptional and unimportant.

The preparation of the patient is limited to rest in bed, an evacuating enema the day before the operation and the injection of sedol half an hour before the operation if local anæsthesia is to be used.

The operation is performed under spinal anæsthesia with novocain or under local anæsthesia; exceptionally in patients who are very timid general ether anæsthesia may be used. When local anæsthesia by infiltration with ½ per cent novocain is used it is completed by a regional injection of 1 per cent novocain, after the manner of Braun.

TECHNIQUE

The steps of the operation are as follows:

Transverse incision of the skin above the bisiliac line 4 to 6 centimeters in length according to the thickness of the panniculus adiposus, the middle point of which is 6 or 7 centimeters within the left anterosuperior iliac spine (Fig. 1).

The subcutaneous cellular tissue is incised and the vessels in it caught and ligated; the aponeurosis of the external oblique is exposed (Fig. 2).

Separation of the aponeurotic or musculoaponeurotic fibers of the external oblique in order to expose the underlying muscles (Fig. 2).

Separation of the muscle bundles of the internal oblique and the transversalis following the direction of their fibers. After sectioning the thin aponeurosis of the internal oblique with a bistoury the fibers are separated with a blunt instrument: closed scissors or closed Kocher forceps (Fig. 3). In this way the transversalis fascia is reached (Fig. 4).

Section of the transversalis fascia at the inner end of the wound, following the direction of the spermatic vessels. The subperitoneal fat is separated, and the bottom of the peritoneal sac to which the packet of spermatic vessels is adherent pushed inward; the vessels are always found in the lowest and innermost part of the operation wound (Fig. 5).

The arteriovenous packet is isolated with a blunt instrument and lifted up on the same instrument in order to inspect and isolate the artery. If the artery is not found at once, the vein or veins which accompany it are isolated, care being taken to spare the cellular tissue

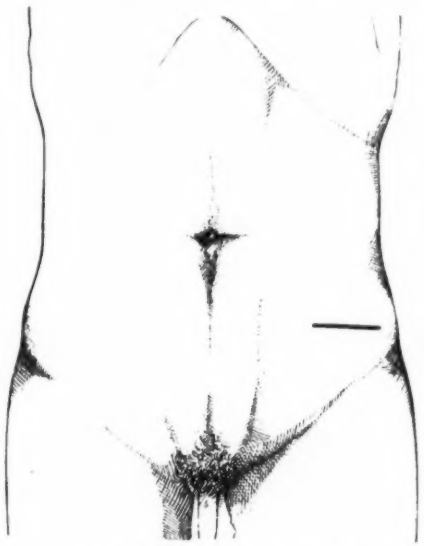


Fig. 1. Incision of the skin and subcutaneous cellular tissue.

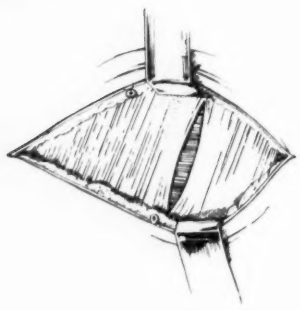
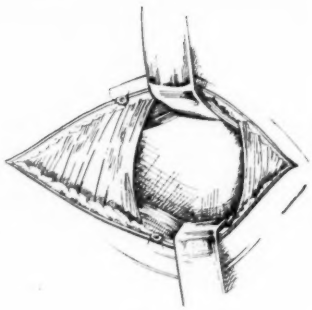


Fig. 2.

Fig. 3.



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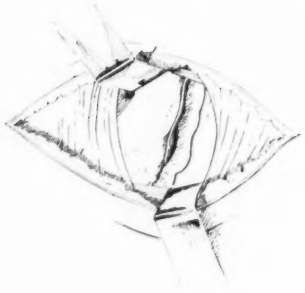

Fig. 5.

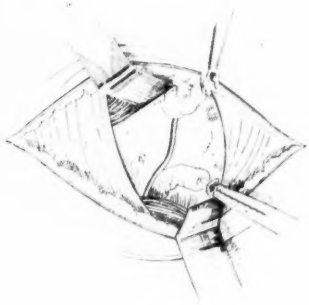

Fig. 6.

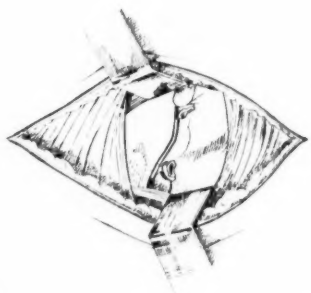

Fig. 7.

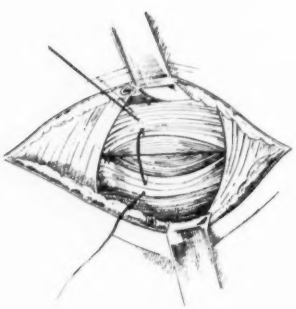

Fig. 8.

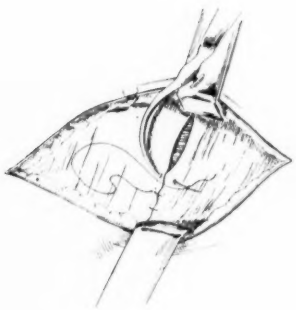

Fig. 9.

Fig. 2. Separation of the aponeurotic fibers of the external oblique. The muscle bundles of the internal oblique appear.

Fig. 3. Separation of the muscle fibers of the internal oblique and transversalis.

Fig. 4. The fibers of the three large abdominal muscles being separated, the transversalis fascia appears and beneath it the subperitoneal fat.

Fig. 5. The spermatic artery and a large venous trunk appear. The upper retractor pushes the peritoneum inward and upward.

Fig. 6. A piece of the venous trunk is resected.

Fig. 7. The two ends of the venous trunk from which a portion has been resected are ligated.

Fig. 8. The operation being finished the internal oblique and transversalis muscles are sutured in one layer with interrupted sutures (3 sutures).

Fig. 9. The edges of the incision in the aponeurosis of the external oblique are brought together with a continuous suture.

which surrounds them in order not to wound the artery hidden in this tissue; generally there are two venous trunks. Two Kocher's forceps are placed 2 centimeters from each other; the segment of vein between the two forceps is resected and the two ends ligated with fine catgut (Figs. 6 and 7). The arteriovenous packet is thus reduced to a slender tract made up of the rest of

the common vascular tunic, the spermatic artery together with its nerve plexus and the lymphatics of the testicle.

The vessel packet is replaced in the wound and the abdominal wall sutured over it in three layers, the first formed by the internal oblique and transversalis, with catgut (Fig. 8); the second formed by the external oblique also with catgut (Fig. 9); and finally the skin with horsehair or silk (Fig. 10). Michel's hooks may be used for the latter, in which case the subcutaneous cellular tissue should be previously sutured with fine catgut.

The wound is covered with gauze kept in place by two adhesive bands; the scrotum is never bandaged or a suspensory used.

POSTOPERATIVE CARE

The postoperative care consists in bringing about an evacuation of the intestine on the third or fourth day after the operation and removing the sutures on the seventh day.

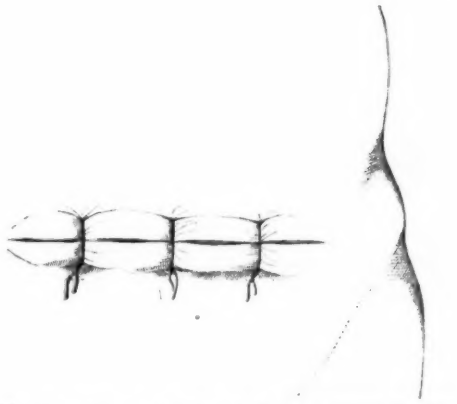

Fig. 10. Suture of the skin and subcutaneous cellular tissue with interrupted sutures.

No local or general accidents have been seen. The prognosis is good.

THE MANAGEMENT OF CARCINOMA OF THE ŒSOPHAGUS[1]

By M. C. MYERSON, M.D., New York
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CARCINOMA of the œsophagus occurs usually in men after the age of 50. In my series, the youngest was 33, while the oldest was 72. Vinson (16) has encountered carcinoma of the œsophagus in women once to every five times in men. In an experience with more than 100 cases, I can recall only seven women with carcinoma of the œsophagus. The most frequent site of the carcinoma is in the middle third of the œsophagus. The carcinoma occurring at the lower end of the œsophagus is in the majority of cases associated with, and secondary to, a carcinoma of the stomach. The efforts of the surgeons and the radiotherapists to effect a cure in these cases deserve commendation and support. Surgery such as has been performed by Lilienthal (7), Willy Meyer (9), Franz Torek (14), Hedblom (3), and others holds a promise for the future. Better results will be obtained if earlier diagnoses are made. Quick (10), who has had a large experience with irradiation in œsophageal malignancy, is of the opinion that this type of lesion has been little influenced by radium therapy. While others are bending their efforts to learn the cause of cancer, it is our duty to make the remaining term of life of these patients as comfortable as possible. There are certain accepted forms of treatment for carcinoma of the œsophagus. Today, gastrostomy is advocated by a majority of men, and has a strong supporter in Jackson.

Only too frequently the conduct in such a case is to wait until the patient can no longer swallow, and then to have a gastrostomy performed. This delay is not to the best advantage of the patient. As Jackson (5) urges, gastrostomy should be performed early; it is a safe procedure when performed on patients in the early stages of the disease. As the later stages are approached, the mortality percentage makes its appearance and increases according to the poorer condition of the patient. Gastrostomy entails hospitalization. It also requires that the patient must feed himself through a funnel and a tube by way of the stomach. Gastrostomy is known to be uncomfortable and embarrassing.

Dilatation of the stricture is practiced by a few, principally Vinson and Moersch (17) of the Mayo Clinic, who have performed several hundred such procedures for cancer of the œsophagus. Vinson favors the dilatation of the carcinomatous stricture, for which he uses the Plummer dilators. These are introduced behind a flexible, spring-like end, which is threaded over a previously swallowed string. Some use the semisoft flexible fiber bougies of Jackson or Guisez, while others favor the string methods of Sippy, Mixter, Plummer, or Vinson. The bougies of Jackson and Guisez are not safe for multiple strictures, while the string method seems to be dependable and carries the bougie through all the strictures at the same time. Blind bouginage is mentioned only to be condemned, and to emphasize that this procedure was lost to medicine with the arrival of the œsophagoscope, and has long been obsolete.

A third method that has not yet been taken up in this country to any extent is the method of dilatation plus intubation of the carcinomatous area. In 1920, Lynah (8) reported three cases in which he intubated the upper œsophagus. It is this method of dilatation plus intubation which has interested me and which I have come to regard as a proved substitute for gastrostomy and an improvement over dilatation alone. The dilatation of the carcinomatous strictures by stringed bougies is safe and saves the patient gastrostomy. But the stricture soon reasserts itself, and further bouginage is necessary. Vinson (18) states that by this means the œsophagus in his patients is kept patent for as long as 2 months. When intubation is practiced, dilatation is required only once, and the tube is worn for the rest of the patient's days. Rubber tubes must be renewed, but the sterling silver spiral tubes which are used by Souttar (11), and the sterling silver tubes that I use do not require changing. They may require replacement or adjustment. The statement that a cancer should not be stretched may be significant for accessible malignancies. But a cancer of the œsophagus, which is safely accessible only with the œsophagoscope, is in a class by itself and deserves special consideration and special means of management. At the present time with a 100 per cent mortality, our greatest concern should be the patient's comfort during his remaining life; and this is better obtained with dilatation and intubation than by gastrostomy alone. Guisez cites an experience that includes

[1] Accepted as candidate's thesis for the American Laryngological, Rhinological, and Otological Association, November, 1925.

Fig. 1. Carcinoma of middle portion of œsophagus in a man, aged 50.

1,430 cases. He found that the patients who can take food gain in weight.

Fig. 3. Barium mixture passing through and around tube, which was placed August 10; patient died suddenly October 9, of internal hæmorrhage.

Fig. 2. Tube in strictured area after œsophagoscopic dilation with Plummer bougies, over a string previously swallowed.

I would urge that all peroral œsophagoscopic bouginage be performed over a string previously swallowed. This would insure against perforation which cannot be avoided in 100 per cent of œsophageal strictures in which the Jackson or

Fig. 4. Roentgenogram illustrating a case in which the œsophagus is practically completely closed by a carcinoma.

Fig. 5. Same patient. Roentgenogram shows a 3½ inch intubation tube in position through strictured area. The tube was so well balanced that the barium mixture passed through too rapidly for an X-ray impression.

Guisez bougies are used for dilation. Tucker (15) is of the opinion that œsophagoscopic bouginage is relatively safe in careful hands.

Fig. 7. Same patient. Roentgenogram showing barium mixture passing both through and around tube.

Fig. 6. Roentgenogram showing tube implanted through strictured area.

There are two distinct phases of the technique. The first has to do with the dilatation of the strictured area; the second with the placement of the tube. The first part of the technique follows essentially that practiced by Vinson (19) with the exception that the stringed bougie is passed through the œsophagoscope. I have been using a larger tube than has been employed heretofore. The tube is introduced with the aid of the œsophagoscope, but not through the œsophagoscope, therefore a larger tube can be used.

The patient is given 5 yards of buttonhole twist, size D string or number 3 or 4 braided silk to swallow, 24 or 48 hours prior to the time of œsophagoscopy. At œsophagoscopy, the string is drawn taut and the largest Mosher œsophagoscope is passed over it down to the carcinomatous stricture. The Plummer bougies are now threaded on the string and the stricture dilated under direct vision. This can be done until the No. 29 French bougie is reached. After this degree of dilatation is accomplished the involved area may be further dilated by manipulating the No. 29 French bougie or if desired a larger bougie can be threaded and passed through after the withdrawal of the œsophagoscope. The No. 29 French bougie gives a dilation of 10 millimeters.

The dilatation having been accomplished, the intubation tube is dropped into the upper œsophagus by means of a Jackson upper œsophageal speculum. The intubation tube is now resting on the carcinomatous area or has dropped partly through it. The Mosher œsophagoscope is again introduced and the intubation tube is slowly and

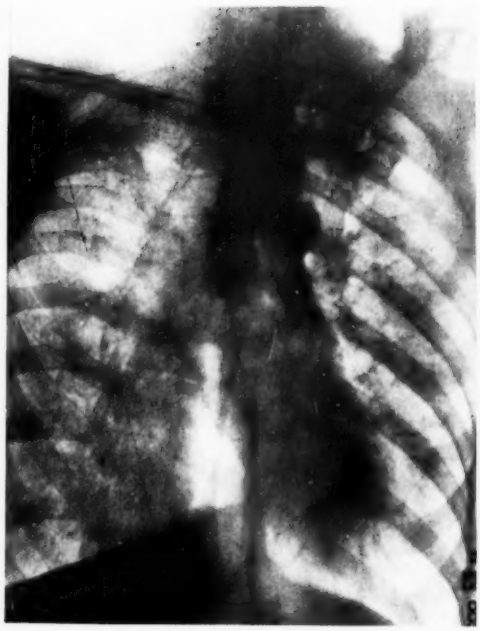

Fig. 8. Roentgenogram showing carcinomatous stricture of middle thoracic portion of œsophagus.

Fig. 9. Same patient. Roentgenogram showing intubation tube in place. In this case the tube became displaced, but served to canalize the strictured area, so that the carcinoma remained patent until death, almost 4 months later.

gently placed in position by means of large heavy grasping forceps. A Jackson bougie may be employed to assist in the advance of the intubation tube, but this is not usually necessary.

If the condition of the patient is such that he cannot withstand at one session all the manipulation which the intubation entails the procedure can be carried out in two stages. The first stage, then, would end with the dilatation, while the second stage would be devoted to intubation. In my experience, the dilatation of any type of stricture, whether benign or malignant, is better carried out with the stringed bougie, œsophagoscopically directed, than by any method so far advanced in the absence of a previous gastrostomy. When it is felt that the patient cannot stand too much, instead of using the two stage procedure just described, it has been found advantageous to introduce a 5 by 9 millimeter tube through the œsophagoscope, so as to shorten the duration of the patient's time on the table.

Dilation and intubation as palliative measures in these cases have been used before.

The earliest intubation of carcinoma of the œsophagus was undertaken by Krishaber (6) of Paris, who reported his first results before the International Medical Congress of 1881. Krishaber intubated four patients with œsophageal cancer for periods of 305, 46, 167, and 126 days respectively. His work was immediately recognized, for Croft reported his results with the same method in two cases a few months later. Croft kept one patient catheterized for 149 days, while the other wore the catheter for almost 4 months.

The arguments in favor of the method as given by Krishaber and substantiated by Croft (1) were:

1. The catheterization can be safely performed.
2. The presence of the catheter is not dangerous.
3. The method can be utilized when gastrostomy is out of the question.
4. The beneficial results are immediate and last as long as the patient lives.

In 1884, Charters Symonds (12) employed his method of catheterization at Guy's Hospital. He first utilized a section of a red gum urethral catheter, 5 inches long, which was blindly but gently introduced into the strictured area with the aid of an ordinary bougie. Symonds (13) still

utilizes this type of intubation; he now uses silk web fiber tubes which are introduced with the aid of a whalebone stylet. Without the employment of the œsophagoscope, such a procedure can hardly be sanctioned.

In 1911 Hill (4) reported his experience with a styletted rubber tube, which he introduced through the carcinomatous area over a previously swallowed thread through the œsophagoscope, after the stricture had been dilated by bougies of graduated sizes. His was a modification of the Symonds long rubber tube. It is this method of Hill's that I have followed and of which I was not aware earlier in my work.

Lynah prolonged the lives of three patients with œsophageal cancer. He used a 4 millimeter soft rubber intubation tube in one case. In another he used a short silver tube, to the lower end of which was attached a piece of rubber tubing.

Guisez (2) has been using rubber intubation tubes for some time, and prefers this method of treatment to gastrostomy.

Souttar has been using tubes made of spiral wound, German silver wire which he introduces through the œsophagoscope. His largest tube is 8 centimeters long and 10 millimeters in diameter; the smallest is 6 centimeters long and 6 millimeters in diameter. These are funnel shaped at the upper end.

My tubes are oval, of solid German silver, of light weight and vary from 3 to 4½ inches (8 to 11 centimeters) in length. They can be cut shorter if necessary. The tubes are made in two sizes, 10 millimeters by 6 millimeters, and 15 millimeters by 10 millimeters being the measurements of the lower ends. The upper ends are expanded and funnel shaped.

After the tube has been implanted, fluoroscopy is employed to ascertain its proper placement, and the patency of the œsophagus is studied with the aid of a barium mixture. The patient is now permitted to eat anything he chooses provided he eats small enough quantities for each bolus and masticates his food well. He enjoys the pleasure and comfort of the family table and has nothing to be sensitive about. It is advisable that he drink milk, water, tea or coffee occasionally during his meal to wash through the tube. In addition to the passage which the tube itself provides, the presence of the tube seems to cause further passage between its outer wall and the wall of the œsophagus.

I have employed this method in five patients and am satisfied as to its feasibility and value. In one of the patients the intubation was unsuccessful, because the tube was too short for the strictured area. Since that experience, some longer tubes have been made.

In dilatation and intubation, we have a method that bids fair to supplant gastrostomy as a palliative measure in the treatment of carcinoma of the œsophagus. My tubes, being of a larger caliber than any heretofore used, insure more adequate passage for food going to the stomach. The patient does not feel the presence of the tube and can swallow the food he has been accustomed to partake of, provided he is careful. He can enjoy solid foods with my tubes whereas only liquids could be taken with the tubes that have been devised by Krishaber, Croft, Hill, and others.

The tube is not easily displaced and remains in the carcinomatous area for comparatively long periods of time. The inside of the tube is smooth so that food particles do not adhere to it. Guisez has shown that patients who are able to swallow sufficient food increase in weight. With sufficient nourishment comes better health and greater strength.

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CHARCOT JOINTS IN A CASE OF SYRINGOMYELIA

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From the Orthopedic Service of the Massachusetts General Hospital

THE presence of remarkable joint changes in a patient recently admitted to the orthopedic service of the Massachusetts General Hospital, combined with other lesions of an unusual character, furnishes the basis of this report.

A male, aged 17 years, was admitted complaining of swelling and weakness of the left knee of 3 years' duration. Patient is of French Canadian parents but has always lived in the state of Vermont. Father died of cancer of stomach, age unknown. Mother died of heart trouble, age unknown. One brother and a sister are living and well. One brother died at birth, cause unknown. Patient does not know about his childhood diseases. Had influenza in 1918 with good recovery. Has only reached the fifth grade in school.

The left knee began to swell about 3 years previous to his admission. Previous to this, the exact time being indefinite, an operation was performed on his left ankle for "tuberculosis," and at the same time amputation of the first, second, and third toes was done—the distal phalanges only being removed. Dating back for a period of about 10 years the patient has been troubled with "blisters" which formed on the toes and fingers. These have never been painful; healing took place slowly, often with some loss of bone from the distal phalanges.

Physical examination (Figs. 1 and 2). The patient is fairly well developed. The facies suggests some mental retardation which is borne out as one questions the patient. The positive findings in the case are a striking enlargement of the left knee joint—the disturbed joint is evidently filled with fluid and there is marked hypermobility of the joint and no pain on movement. There is a similar enlargement of the left ankle with some tendency to equinus (Figs. 3 and 4). The right knee shows some excess of fluid and a slight amount of capsule thickening, but no hypermobility. The scar of the operation is present on the inner side of the ankle joint and is well healed. The amputated toes are healed with practically no scars. On the first and second toes of the right foot are ulcerations through the skin, involving the terminal phalanges. The hands show ulcerations, fresh and partly healed, about all of the distal phalanges and on most of the fingers the nails are partially destroyed. There is partial motor paralysis involving the extensors of the toes of the left foot. The deep reflexes are present with the exception of the knee jerk on the left. The knee jerk on the right is obtained only with reinforcement. There is no ankle clonus or Babinski. The disturbance of sensation (Fig. 5) is segmental in type. There is anæsthesia to pain, heat, and cold over the area marked on the chart. Over the feet and the left leg, there is slowness of response to tactile discrimination and muscle sense stimuli. In the hands, a similar condition exists although the muscle sense seems better preserved. There is some enlargement of the epitrochlear and inguinal lymph nodes.

The blood examination showed hæmoglobin, 95 per cent; red blood cells, 4,850,000; white blood cells, 9,800. Differential count, polymorphonuclear, 68 per cent; lymphocytes, 29 per cent; eosinophiles, 1 per cent; transitionals, 2 per cent. The urine was negative. The blood Wassermann was negative. The spinal fluid showed a count of 1 cell per cubic millimeter, Wassermann negative, total protein 22, colloidal gold solution 0001110000. Smears from the nasal mucosæ made after administration of potassium iodide showed no acid fast bacilli. An excised epitrochlear gland and a piece of the external popliteal nerve of the left leg, also, showed no acid fast bacilli.

In Charcot's (1) original article he described four cases of sudden painless swelling of joints associated with the characteristic lesions then known as locomotor ataxia. He mentions no other possible causes in that article although he refers to the cases of joint lesion described by Mitchell (5) in 1831 accompanying Pott's disease with paraplegia. These Charcot believed to be "subacute articular rheumatism." In a later publication, Charcot (2) mentions the possibility of the so-called arthropathies occurring in paraplegia from Pott's disease and in injuries to the spine.

Chipault (3) later mentioned several possible causes of Charcot's joints; such as Pott's disease with paraplegia, injuries to the cord by fracture of the spine, and tumors of the cord and meninges, and cites cases of his own and others in support of his contention.

Turney (12) gives as causes of Charcot's joints, tabes, syringomyelia and injuries, and in addition states that the weight of evidence shows that Charcot's joints may occur in leprosy.

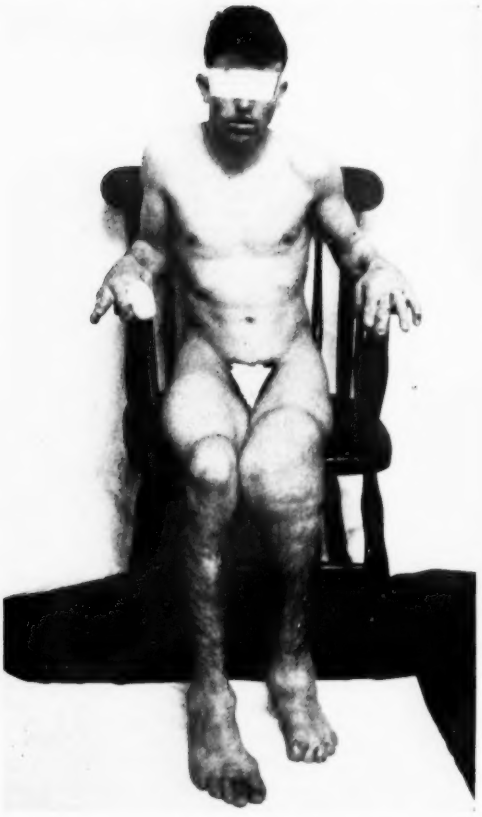

Fig. 1. Photograph of patient showing enlargement of the left knee joint and of the left ankle, and amputation of great toe on left foot. Note also the ulcerations on the fingers of both hands and on the toes of the right foot.

Fig. 2. Photograph of hands showing ulcerations about the terminal phalanges of all the fingers. Some are healed, others in a more active stage.

Fig. 3. X-ray of hands. Note destructive changes in terminal phalanges.

In later publications, many cases of so-called neurotrophic arthropathies have been described. While the majority of cases no doubt occur in syringomyelia and tabes dorsalis, a great number of textbooks fail to mention the possibility of these joints occurring in other conditions. Philips and Rosenheck (8) report two cases of trophic joint disturbance in peripheral nerve injury "venturing to formulate, that a neuro-arthropathy may be wholly the product of a peripheral nerve disease or injury."

We were then confronted with the question of determining the causative factor in a case of multiple Charcot's joints in a youth of 17 years. Tabes was satisfactorily excluded by (a) the age of the patient, which is unusual for this disease without history of infection, (b) the negative blood and spinal fluid examinations, (c) the presence of a knee jerk in the right leg, (d) the unusual sensory disturbance, (e) the absence of eye changes.

Schlesinger, whose monograph (9) is the classic on syringomyelia, states that at times one of the most difficult diseases to differentiate from syringomyelia is leprosy. The essential points in the differential diagnosis are outlined by Schlesinger (10) and corroborated in fact by Hanel (4) and Oppenheim (7). They are: Leprosy must be contracted by contact, therefore most cases come from an area where this disease is endemic, while syringomyelia is probably never gotten by contact. In leprosy there are usually spindle shaped swellings along the peripheral nerves, usually demonstrable in the greater auricular nerve, and one can often demonstrate the bacilli in a piece of the excised nerve. The anæsthesia in leprosy being due to a peripheral nerve lesion is practically always patchy and there are usually areas of skin devoid of pigment. In syringomyelia, however, the anæsthesia is segmental in type. In leprosy there is often peripheral facial paralysis, which is

Fig. 4. Lateral X-ray of left knee showing changes typical of Charcot's joint.

rare in syringomyelia. In leprosy depilation is common in certain areas, particularly the eyebrows and eyelids, while it is uncommon in syringomyelia.

In connection with syringomyelia should be mentioned a disease described by Morvan (6) as a clinical entity. Starr (11) says that Morvan's disease has been proved to be syringomyelia as autopsies on some of the cases showed cavities in the spinal cord. Most writers now refer to this as a form of syringomyelia. It should be pointed out that Morvan's cases were of analgesic and painless whitlows of the upper extremities only.

Finally, there exists a certain amount of confusion due to the fact that in cases of syringomyelia, lepræ bacilli have been demonstrated in the cord, and Starr includes infection as a possible cause of syringomyelia.

To summarize briefly the evidence in this case for syringomyelia and against leprosy and tabes, we present these facts:

A. Charcot joints (Turney) may occur in (1) tabes dorsalis (2 to 4 per cent of cases); (2) syringomyelia (10 to 40 per cent of cases); (3) spinal injuries, and (4) spinal caries, rare; (5) leprosy (Hansen).

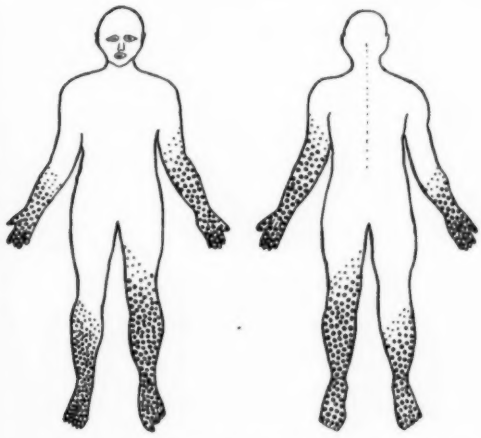

Fig. 5. Charts showing distribution of anæsthesia. Pain, heat, and cold are absent over the areas marked. There is some disturbance of muscle sense on the left leg

B. 1. Tabes: (a) no pupillary changes, (b) knee jerks present on reinforcement on right, (c) negative Wassermann, (d) normal spinal fluid. *2. Syringomyelia:* (a) sensory dissociation, (b) trophic changes in hands and feet, (c) multiple neurotrophic arthropathies, (d) segmental distribution of sensory changes. *3. Leprosy*—anæsthetic type: Most important differential diagnosis from syringomyelia (Schlesinger). (a) No evidence of any contact, (b) lack of spindle shaped nerve thickenings, (c) failure of demonstration of bacilli in excised nerves, (d) peripheral facial paralysis absent, (e) oval cicatricial patches devoid of pigment absent, (f) discrete patches of anæsthesia not found.

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PREVENTION AND RELIEF OF PROLAPSUS UTERI[1]

By ROLAND S. CRON, M.D., F.A.C.S., Milwaukee, Wisconsin

THE problem of the prevention and relief of prolapsus uteri with or without rectocele or cystocele has been one that has confronted mothers as well as physicians ever since the act of childbirth has become more of a pathological process than it was generations ago. There can be no doubt left in the minds of medical men that the higher one ascends the scale of culture, refinement, and education, the more frequently does one find abnormalities in the childbearing functions of women. In part this is due to the change in musculature and in part to the nervous instability of the woman. The expulsive forces which are brought into play at the time of labor are probably not as efficient nor as effective as they were a few generations back when women were compelled to exercise more freely. This, coupled with the idea that a woman should labor for a certain prescribed number of hours and then to experience only a minimum amount of pain, has induced physicians to hasten many deliveries by one means or another.

In order to prevent uterine prolapse and its associated complications, one must first understand the cause and method of production of such conditions. Undoubtedly congenital defects in the development of supporting structures such as fascia, ligaments, muscle, and the inclination of the pelvic bone as well as malpositions of the various pelvic organs, especially the uterus, are great factors in the production of prolapsus. If this were not true, every woman subjected to one of the activating causes would be going about with a descensus of one or all of the pelvic organs.

Given an individual with a defective pelvic anatomy, childbirth may be the link in the chain which eventually results in a prolapsed uterus. A precipitate labor or one hastened by the administration of pituitary extract may so loosen the attachments of the bladder, rectum, or uterus that they will descend in the path of least resistance. Again a forceps delivery, especially if performed through a partially dilated cervix, or any difficult operative maneuver may strip and tear the fascia, ligaments, and muscle to the extent that only a most thorough reconstructive operation will later support the pelvic organs. In order to prevent such a thing from happening it has been our custom in most primiparous labors and operative deliveries to perform a mediolateral episiotomy before the presenting part has extensively stretched the perineum. It is doubly important to perform this prophylactic operation during a protracted second stage of labor especially in cases in which the bladder is being rolled off of its anterior attachments or in which the pubic arch and the correspondingly contracted bisischial diameter forces the head through the soft parts. Furthermore, the operation directs any continuation of the incision by tearing to the right or left of the rectum, thereby preventing a third degree laceration. It is an accepted fact that a clean cut wound is more satisfactory to repair and that it heals more rapidly and accurately than one the result of a tear. As a result of following this line of reasoning my associate, Dr. Davis, and I have performed 294 episiotomies during the last 500 deliveries *per vaginam*. Fifty-three per cent of normal labors were assisted by this operation while 63 per cent of operative deliveries were preceded by a mediolateral incision of the perineum. The feasibility of this procedure has been definitely proved when 6 weeks postpartum one finds the soft parts healed to the extent that they resemble those of a nulliparous woman.

All lacerations of the soft parts should be discovered and immediately repaired. Frequently submucus lacerations of the muscle and fascia occur without a break in the skin or mucus membrane. Recently a semicircular mattress suture has been satisfactorily used in this type of tear and also in old relaxations of the posterior vaginal wall.

A common complication of labor and one that is conducive to cystocele and prolapsus is a full bladder. There is nothing less compressible than a bag of water. It is, therefore, imperative that the patient empty the bladder frequently and completely or else that the urine be withdrawn by means of a catheter at regular intervals.

There are a number of steps in the evolution of a condition such as a prolapsed uterus. It is usually preceded by retroversion of the uterus then beginning descensus with elongation and hypertrophy of the cervix. This is frequently associated with a cystocele or rectocele or both and then the appearance of the cervix outside of the vagina, and if this condition is not remedied a complete prolapsus of the uterus, and occasionally a herniation of the posterior cul-de-sac may result.

[1] Presented before The Chicago Gynecological Society, March, 1926. (For discussion, see page 714.)

In a beginning prolapsus, the situation can usually be satisfactorily remedied by a proper operation on the cervix, pleating or overlapping of the bladder fascia with advancement if necessary of the bladder on to the lower segment of the uterus, a colpoperineorrhaphy, an anterior subfascial shortening (modified Gilliam) of the round ligaments and, if necessary, shortening of the sacro-uterine ligaments (Bovée technique). When however, the beginning prolapsus is associated with a large cystocele and likewise in the majority of cases of second degree descensus of the uterus, the operation of choice is one first described by the late Thomas J. Watkins. It consists in interposing the fundus of the uterus between the bladder and anterior vaginal wall. The uterus acts as a very efficient plug for the herniated bladder. This operation is then followed by a very thorough and extensive repair of the posterior vaginal wall and perineum. When the cervix is elongated, hypertrophied, or ulcerated it should be amputated before the sutures suspending the anteflexed uterus to the anterior vaginal wall are tied.

It has been possible to review the records and to follow up the patients on whom the Watkins interposition operation has been performed by thirteen different operators during the past 14 years. An analysis of these records follows. The analysis covers a series of 225 patients operated upon during the period 1910 to 1924, 14 years. The youngest patient was 20 years of age, the oldest 72 years, the average being 54 years.

The operation should be reserved for patients who have reached the menopause or are approaching it. There were 59 women still menstruating; all but 12 were sterilized by resection of the fallopian tubes and burial of the resected tip below the peritoneum. One of those not sterilized later conceived. Because of a dystocia, the result of a malposed uterus, and a placenta prævia she was delivered by cæsarean section. She died from hæmorrhage and subsequent sepsis.

There was no relation between the number of labors and the frequency or extent of the pelvic lesion. Two women had never borne children. One of these was aged 50 years and had had a complete prolapse for 8 years, while the other aged 62 was found to have a second degree descensus with a large cystocele. Eighty-five patients were delivered by operative measures and only 13 admitted having had a repair done at the time of the labor. Apparently instrumental deliveries are not as important a factor in the cause of prolapsus as failure to properly repair the pelvic diaphragm.

TABLE I.—DIAGNOSIS

	Cases
Complete prolapse	46
Second degree prolapse	109
First degree prolapse	42
Retrodisplacement with cystocele or rectocele or both	20
Cystocele and rectocele	8
Complete laceration	8

It is interesting to note that about one-fifth or 46 patients had a prolapse to the extent that it was considered complete while in others there was very little descensus (Table I). Even so the interposition operation was used in all to correct the pelvic pathology. It is exceedingly rare to find a condition of complete laceration of the perineum and descensus of the uterus in the same patient. This did prevail eight times, twice when the diagnosis of complete prolapse had been made.

TABLE II.—OPERATIONS—THIRTEEN OPERATORS

Watkins interposition	225	Ovarectomy	7
Colpoperineorrhaphy	223	Myomectomy	5
Amputation of cervix	122	Perforation of rectum	2
Dilatation and curettage	85	Perforation of bladder	2
Resection of tubes	47	Obliteration of vagina	2
Complete tear	8	Herniotomy	3

All but 2 of the 225 interposition operations performed were followed by colpoperineorrhaphy (Table II). When necessary even more extensive support was given to the posterior vaginal wall. Some cervical operation, usually an amputation, was found advisable in more than one-half of the patients. Accidental perforation of the bladder or rectum in 4 patients did not seriously complicate their recovery.

TABLE III.—ANÆSTHESIA

General—ether, gas oxygen or ethylene	212
Spinal	3
Local	10

Since the operation is frequently performed on senile women who are consequently bad risks, it is at times advisable to administer one of the compressed gases such as nitrous oxide oxygen or ethylene (Table III). The operation may also be done under spinal or local anæsthesia without appreciable discomfort to the patient, provided there is a minimum amount of peritoneal manipulation.

TABLE IV.—POSTOPERATIVE RECOVERY

Afebrile	124	Catheterized	174
Febrile	64	Urinated spontaneously	49
Febrile (1 day)	35		

If one will consider a rise of temperature to 100.4 as a normal postoperative reaction, one finds that a comparatively small number, 64

patients, had a febrile convalescence for more than 1 day (Table IV). With the establishment of routine catheterization until the residual urine in the bladder after spontaneous micturition was reduced to 1 ounce, and with the instillation of 1 ounce of 1:800 silver nitrate solution into the bladder following catheterization, it was found that the convalescence was more frequently afebrile and associated with very little bladder disturbance.

Postoperative cystitis in 32 patients and suppuration of the anterior or posterior vaginal wall in 20 others complicated the convalescence and undoubtedly were the causes of the elevated temperature. The repair of a third degree laceration was a failure. Two operative deaths occurred. Both patients were poor risks but hæmorrhage from the stump of an excised ovarian cyst in one and oozing from the bladder plexus in the other were the deciding factors between life and death.

TABLE V.—ULTIMATE RESULTS

		Cases
Patients followed up		183
Satisfactory	(90%)	152
Minor complaint		13
Rectocele or cystocele		8
Beginning prolapse		1
Recurrence (3.8%)		7
Operative deaths (1%)		2

These patients were either seen one or more years after the operation by the family physician, or the operating surgeon; or they answered detailed questionnaires covering their symptoms and the ultimate condition of their pelvic organs. Complete relief of the symptoms from which the patient complained was obtained in 152 cases, while the only complaint in 13 others was that of a slight difficulty in micturition or defecation (Table V). Considering this latter group as being relieved of their more serious and distressing symptoms, one can feel that at least 90 per cent of the patients obtained both a functional as well as a reconstructive cure. A few had a recurrent cystocele or rectocele easily remedied by a plastic operation. There were 7 patients who did not derive any benefit from the operation. Recurrence of a complete prolapsus followed extreme exertion in three instances while in the case of two others the uterus returned to its position at the introitus within 3 months following the operative correction. Two of the uteri interposed were atrophic and therefore too small to act as an efficient tamponade. Postoperative infection did not seem to be a factor in accounting for the recurrence, for the convalescence in five of this group was afebrile.

Many other operations have been used to cure prolapsus. One of the most satisfactory for complete prolapsus especially in patients in whom it is advisable to remove the uterus, is a combination of a vaginal panhysterectomy with overlapping of the bladder fascia and anchoring of the base of the bladder and vault of the vagina to the conjoined cardinal (round, broad and sacro-uterine) ligaments. With a well constructed posterior vaginal wall, Lynch, Phaneuf and others feel that 100 per cent relief of the prolapsus should be obtained. The fixation of the uterus or of the cervix following supravaginal hysterectomy to the fascia of the rectus abdominalis muscles without repair of the bladder fascia and proper support to the perineum gives only temporary relief. If a firm pelvic floor has been built, the abdominal work is unnecessary and only adds to the mortality. The cystocele like any other hernia cannot be cured unless the fascia through which the rupture has occurred is properly restored or plugged by some fixed object.

The interposition operation is successful because it uses fixed structures for support. The uterus acts as a shelf to hold the bladder and is elevated in the pelvis by being tipped forward, its position being changed 180 degrees. The twist produced in the broad ligaments by the change in the position of the uterus, perceptibly shortens them, and is the chief factor in correcting the uterine prolapse, and finally as Miller has brought out the tendencies of the uterus and bladder are antagonistic to further prolapse as they work against each other to hold the correct position.

NOTE.—This study was started while the writer was associated with Dr. Reuben Peterson at Ann Arbor, Michigan, and continued by him in Milwaukee. Most of the patients on whom the Watkins operation was done were operated upon by Dr. Peterson and his associates. Through the courtesy of Dr. Peterson, the writer has been given the privilege of reporting these with others operated upon by Dr. C. H. Davis and himself.

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INTESTINAL FISTULÆ

A Method of Preventing Skin Excoriation[1]

By JOSEPH F. SMITH, M.D., F.A.C.S., and H. H. CHRISTENSEN, M.D., Wausau, Wisconsin

DRAINAGE from a high enterostomy presents a formidable condition. In the course of 24 to 48 hours, the skin shows marked irritation. Continued drainage after this time produces a painful, raw, beefy surface and the patient is sorely harassed by the "burning and eating," as it were, from each quantity of intestinal juice emitted with which the external surface comes in contact. The periodicity of the escaping secretions follows the rythmical movements of the intestine and allows of no adequate rest, day or night. The increased peristalsis and the larger quantity of juices ejected from the fistulæ following the ingestion of food becomes especially troublesome and the patient is reluctant to eat; thus, a vicious circle is established which often threatens the patient with starvation. The patient becomes emaciated, first because of the quantity of nourishment lost by the food escaping from the fistula and, second, because the patient early learns that food taking is soon followed by bowel peristalsis and the escape of irritating bowel contents with greatly increased pain; he learns to avoid pain by refraining from eating. The resulting interference with the physiological processes of rest and nutrition must of necessity decrease markedly the opportunities for recovery and wound healing.

Fistulæ of the small bowel intentionally produced may be carried out by the Witzel or some of the other methods which effectually guard against the possibility of leakage of intestinal contents. In the accidental cases or those arising during the treatment of septic conditions, we have no adequate means of developing the fistulæ under any such satisfactory conditions.

Among the means which have been employed in the treatment of skin excoriation may be mentioned the application of moist dressings, pastes, ointments, and direct exposure of the skin surface to sunlight and air. The intestinal juices quickly and readily undermine any layer of ointment or paste or lift up any film of paraffin or a similar substance applied to the skin, even when the skin is carefully dried before their application. The excoriation of the skin surface then proceeds more violently and rapidly beneath the undermined layer of ointment or paste and tends to spread out widely over the skin surface. The most important feature in the management of small bowel fistulæ consists in preventing promptly by some adequate means the excoriation of the skin about the fistula and the resulting pain and interference with the patient's rest and food taking.

Any rational and satisfactory method of management must be based on processes which eliminate the cause of the excoriation without injury to the patient. It is well known that such excoriation is due to the action of the digestive enzymes poured out in the bowel secretions. Thus, any means of preventing or controlling this excoriation must be based upon some method of destroying or inhibiting the enzyme action. Many methods of producing inactivation of enzymes known to biological chemistry would, for obvious reasons, be unsuitable for use in applications made to living tissues.

E. Fischer (1) discovered that enzymes combine with certain substrates and only when this combination exists is the enzyme chemically active. Substances preventing this combination of the enzyme and the substrate would, therefore, inhibit enzyme activity. Enzymes are readily taken up by finely divided substances, such as inorganic precipitates, charcoal, kaolin, infusorial earth, alumina, iron hydroxide, colloids, proteins, etc., and their activity is thereby inhibited (2). This inhibition, Hedin (3) regards as brought about by a colloidal reaction, by absorption between the enzyme and the solid or colloidal phase. Evidence substantiating this conclusion indicates that during the action of the retarding substance upon the enzyme the quantity of water present, or the degree of dilution, does not affect or retard the final result. This reaction has been shown to be more or less irreversible and results in the binding of the enzyme.

A variation in the efficiency of different substances for absorbing the enzyme has been demonstrated. For practical reasons, kaolin and charcoal are the most useful for this purpose. These substances recommend themselves because, being readily available at small cost, they can be used in quantities sufficient to absorb the escaping fluids. The procedure we have used consists in mixing a sufficient quantity of the sterilized powdered kaolin with glycerine to make a thin paste.

[1] Read before the Western Surgical Association, Wichita, Kansas, December 19, 1925.

The kaolin-glycerine paste is then applied to the body surface surrounding the wound, making a close adhesive dressing next to the skin. Over this, we spread a generous quantity of powdered kaolin to absorb the escaping fluids. This, in turn, is covered with the usual dressings. Charcoal was used at times for the powdered portion of the dressing, but, because of its disagreeable color, it is objectionable for this purpose.

Applications as outlined above have been sufficient to keep the patient comfortable for a period of 5 to 6 hours. As the fistulæ have contracted, two applications in 24 hours have been adequate.

CASE REPORTS

Case No. 15373. A Polish boy, T. R., 7 years old, was admitted to St. Mary's Hospital on September 16, 1924, with a generalized peritonitis from a ruptured appendix. Appendectomy and drainage was done immediately. Obstructive symptoms developed a week later on three different occasions and each time were relieved by the giving of saline solution. A modified Witzel enterostomy was then done with satisfactory results; but the tube, unfortunately, was released on the third day after operation. The skin surface surrounding the wound was covered immediately with zinc oxide ointment. This could not be made to adhere and 3 days later gauze treated with beeswax was applied to protect the skin. This was also disappointing and the skin became very much irritated and painful. Then followed trials of the paraffin spray, boric acid, sunlight, and egg white. None of these means adequately protected the skin, which by this time was weeping and painful. Kaolin and charcoal mixture was then applied several times daily with complete comfort to the patient and a restoration of the skin to quite a normal state. This was continued until November 8, 1924, when the wound was taped shut. The patient was discharged well on November 11, 1924.

Case No. 16157. Mrs. E. B., 53 years old, had redness and burning about the wound following a transduodenal choledochotomy on April 6, 1925, for a stricture of the common duct at the ampulla of Vater. The stools were mushy and foamy for a week. One application of kaolin and charcoal daily was sufficient to protect the skin against further irritation. Ten days later the skin had a normal color. Patient was discharged well on May 8, 1925.

Case No. 16574. Mrs. W. E. B., 45 years old, developed a leakage of the intestine with drainage of bowel contents through the wound 24 days after an abdominal operation. Large quantities of clear yellowish fluid escaped. The wound and the surrounding tissues became markedly injected and painful. Kaolin, as outlined, was used for protection of the surface. A fresh application was made every 5 or 6 hours while the drainage was profuse; later, two applications in 24 hours sufficed. A month later, when the general condition of the patient warranted the attempt, a jejunal fistula was successfully closed. In another month, the patient was discharged well.

SUMMARY

We have presented what we have found to be a rational and satisfactory method of preventing excoriation from intestinal drainage. The enzymes are inhibited by absorption in inorganic substances. Kaolin is preferred, being readily available, easily sterilized, inexpensive, and suitable as a surgical dressing. Patients with small bowel fistulæ can be made comfortable at once by the application of kaolin-glycerine dressings to the skin. Those patients with extensive skin excoriation may be controlled to the extent that the skin and other tissues about the fistula may be restored to a condition which will permit a surgical repair or closure to be carried out.

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EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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NOVEMBER, 1926

THE SAFETIES OF ETHYLENE ANÆSTHESIA

CHLOROFORM as an anæsthetic has been practically abandoned in this country, for its dangers are well known. Ether is no longer considered the ideal anæsthetic for the general surgeon, because pulmonary and gastro-intestinal complications after operation are frequent and its taste, smell, and postoperative effects are obnoxious to the patient. Its administration to the badly injured or seriously ill patient requiring a major operation may be the deciding factor of danger and its use is no longer justifiable in minor surgery. The public in many localities will not consent to its use and the patient comes to the surgeon questioning the kind of anæsthetic which is to be administered.

Nitrous oxide and oxygen anæsthesia has supplanted ether in many clinics, for its advantages over ether are many. However, it may be a dangerous anæsthetic in unskilled hands, for unquestionably there have been many deaths unreported which might be attributed directly to its use. Gwathmey has shown that the margin of safety afforded by ethylene is greater than that of nitrous oxide and oxygen, nitrous oxide and oxygen plus ether, or ether alone. Deep relaxation which will permit major abdominal operations and the reduction of fractures of long bones and dislocations of larger joints is extremely difficult to obtain even with the addition of ether to the mixture.

In 1923 Drs. Luckhardt and Carter after much experimenting with ethylene gas suggested its use as a surgical anæsthetic. Dean Lewis and W. E. Brown were the first to employ it, believing it to be a safe and satisfactory anæsthetic.

The gas was known to be explosive and this was emphasized by these early workers. A few small explosions with no injury to patient or anæsthetist occurred in the machines in some clinics. These were due to the static friction spark, which at that time was but little understood and no safeguards were employed in the machines to cope with this danger. A most unfortunate and widely heralded fatal explosion charged to ethylene occurred later; but as a matter of fact this occurred during an operation while nitrous oxide, oxygen, and ether were being administered. Ethylene had been given to this patient during the first part of the operation. The profession was so frightened by this fatality that it has been tardy in employing this anæsthetic which to the minds of those who use it is most satisfactory and safe.

The modern gas machines are made to carry off the static electricity and ground it so that the danger of an explosion from the static spark is nihil. It is unsafe to use a cautery or free flame of any kind in the oper-

ating room during the administration of ethylene. The surgeon, therefore, who employs it must forego the use of the cautery in gastro-intestinal operations.

Another objection to its use is its disagreeable sweetish sorghum odor. This odor is not at all disagreeable to the patient however. The operating team soon become accustomed to it, and the visitor to the clinic alone notices it.

These may be said to be the objections to ethylene—what about its advantages? They are many. Its ease and quickness of induction, its pleasantness to take, its quick awakening with the absence of postoperative retching and vomiting since carbon dioxide has been added to the mixture at the close of operation and the postoperative comfort and infrequent gastro-intestinal complications are all in its favor. Relaxation can be obtained which will permit major abdominal operations and the reduction of fractures of long bones and dislocations of larger joints. It is rarely necessary to add ether to the mixture if local anæsthesia is used, but a co-operation between the anæsthetist and the surgeon is most important to get this deep relaxation.

Ethylene does not stimulate the respiratory center. The respirations are smooth and regular and resemble those of normal sleep. There is not the stimulated labored respirations seen in nitrous oxide and oxygen and ether. The skin is closed and dry, and the patient's color remains pink if the proper mixture is used. If too much ethylene is given the patient becomes pale, the respirations shallow, and the pulse slow. Addition of more oxygen to the mixture will revive the patient quickly. After the period of induction the oxygen may be increased 15 to 20 per cent, and as 20 per cent equals the amount of oxygen in the air, there is enough for thorough oxygenation of the blood during the anæsthesia. Cyanosis is absent even though deep relaxation may be required.

There is no excessive secretion of mucus during the period of anæsthesia, and for this reason it is questionable whether the preoperative use of atropine is necessary. The awakening from ethylene anæsthesia is prompt and without excitement so commonly seen in nitrous oxide and oxygen and ether.

Ethylene is an ideal anæsthetic for the poor surgical risk handicapped by cardiovascular, pulmonary, or diabetic complication. As it has little if any effect on blood pressure it is especially valuable as an anæsthetic for the badly injured. In thyroid surgery it is especially recommended. The absence of mucus and the quiet respirations make it extremely safe and any disturbance of respiration during operation for goiter can be charged to the surgeon's manipulations and not to the anæsthetic.

Reports from surgeons who have made so bold as to employ ethylene continually in their work show a great reduction in postoperative pulmonary and gastro-intestinal complications and in their general operative mortality rate.

These are some of the safeties and advantages of ethylene anæsthesia. Surely if a comparison be made, these safeties and advantages will be found to far outweigh the objections and dangers. DONALD GUTHRIE.

MEETING OF THE SEVENTH INTERNATIONAL DENTAL CONGRESS

THE relationship of dental infection to systemic diseases and the rôle that dentistry now plays in preventive medicine were emphasized by the meeting of the Seventh International Dental Congress, which has just been held in Philadelphia. There in one of the old buildings which was used at the

Centennial Exposition over 50 years ago, over 10,000 dentists had gathered from every country where dentistry is practiced. It was beyond question the greatest meeting of dentists ever held in this or any country, and no doubt many years will pass before it can be duplicated or surpassed.

It should be borne in mind that the importance of this meeting was accentuated by an act of Congress. On April 28, a bill was signed by President Coolidge which authorized an expenditure of $5,000 to aid in securing delegates from foreign countries. The official stamp placed on the meeting by Congress accounted in great measure for the large attendance.

More than 400 papers were presented at the meeting, and there were approximately 1200 speakers. There were also from 800 to 1000 dry clinics presented, and these represented every known topic of interest to dentists. The papers and discussions on teeth as foci of infection probably created the most interest, and the result will be a better understanding of the dentist's responsibility in the elimination of dental infection, and its prevention. The papers presented on this subject clearly demonstrated that dentists are recognizing the importance of co-operation with physicians in order to give their patients better care. More patients will be sent to hospitals for the extraction of teeth, and the risk of this operation will be estimated as for any general surgery. Moreover, by such co-operation, the dentist will be in a better position to select the anæsthetic, and to decide when it is necessary to extract all questionable teeth. It is generally recognized that many teeth have been extracted needlessly, but from the standpoint of a menace this is a drop in the bucket as compared with the tremendous amount of infection that is retained in mouths for the purpose of facilitating restorative work.

The epoch-making work of Rosenow and others on elective localization, aided by the generous use of the roentgen-ray, has accounted largely for the change that has taken place in the practice of dentistry. The dentist is now expected to take an active part in the practice of general medicine. Requirements for admission to dental colleges have been raised, and undoubtedly as a result a greater number of high-grade men will study dentistry. It follows that the teeth will be better cared for in future generations than in the past.

BOYD S. GARDNER.

MASTER SURGEONS OF AMERICA

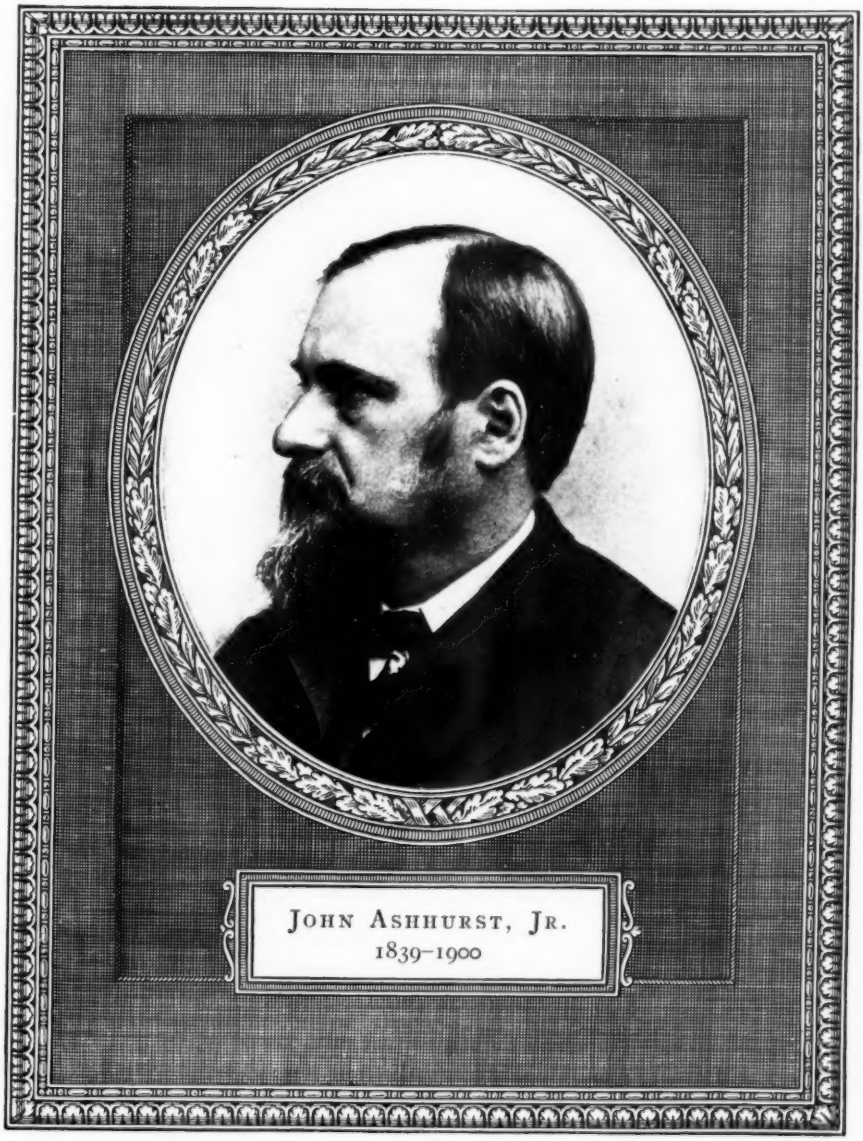
JOHN ASHHURST, JR.

JOHN ASHHURST, JR., M.D., LL.D., was born in Philadelphia, August 13, 1839. He was of English extraction and of a family well known in the intellectual and social life of his native city. His preliminary education was conducted at home under tutors, and finished at the University of Pennsylvania, where his record for scholarship still stands conspicuous in the annals of the College. He studied medicine in the same institution under the preceptorship of Joseph Carson, the professor of materia medica, graduating in 1860. Following this came a year's service as interne at the Pennsylvania Hospital, the oldest hospital in the United States, and then as now one of the most important hospitals of the city. Here he came under the influence of George W. Norris and Joseph Pancoast, two of the strong men of their day. Pancoast was professor of anatomy in the Jefferson Medical College, and perhaps the most brilliant operator Philadelphia has ever seen.

When Ashhurst entered practice, the Civil War was beginning, and like most of the young medical men of the day who afterward attained eminence, he entered the service and served until the end of the war as a contract surgeon in the hospitals in and near Philadelphia. It was probably this experience in military surgery which early centered his interests on lesions of the bones and joints and blood vessels.

During the same period, in 1863, he was elected surgeon to the Episcopal Hospital. Although this hospital was situated in what was then a remote locality, and rather inaccessible by reason of poor transportation facilities, the supply of clinical material was abundant. It was here that Ashhurst built up his reputation as diagnostician and operator, as de Nancrede did later.

At the same time his literary ability was demonstrated in a number of important contributions which familiarized his name to the surgical world at home and abroad. During this period he wrote his classical articles on shock, cerebral concussion and hæmorrhage, and on surgery of the spine, edited the American edition of Erichsen's *Surgery*, and produced the first editions of his very successful and widely quoted textbook on surgery. Most of his special articles during this period appeared in the *American Journal of the Medical Sciences*, or Hays' journal, as the older generation often called it. In the same journal appeared many discriminating book reviews over his initials.



JOHN ASHHURST, JR.
1839–1900

UNIV. OF MICH.

He was called to the chair of clinical surgery at the University of Pennsylvania in 1877. Agnew was then the professor of surgery. At that time the pre-eminence of Philadelphia as a medical teaching center was unchallenged, as Cushing has recently emphasized. The faculty of the University in the seventies and eighties was probably the strongest body of teachers in its history. It was an age of individualists, and the list included besides Agnew and Ashhurst such names as Leidy, Pepper, Duhring, Wormley, H. C. Wood, Tyson, Goodell, R. A. F. Penrose, and Wm. F. Norris. In 1877 the great Gross was still teaching at the Jefferson with Brinton as his associate, while T. G. Morton and John H. Packard were at the Pennsylvania Hospital and the younger Gross and Keen were forging to the front. Agnew was in his zenith as brilliant operator and popular practitioner, while Ashhurst typified the scholar in surgery, a fortunate combination for the students of the school.

To his teaching duties and his position as surgeon to the University Hospital Ashhurst added those of surgeon to the old Children's Hospital and later the Pennsylvania Hospital. His surgical reputation was greatly enhanced by his editorship of the *International Encyclopedia of Surgery* (1880–1886) the contributors to which included the best known surgeons of the United States and Europe. A French edition of this work, with introduction by Gosselin, appeared shortly afterward. Ashhurst's contributions included the articles on amputations, excisions and resections, and intestinal obstruction. This great system made Ashhurst's name as familiar in Europe as it already was in America, and he became generally recognized as the greatest authority in the world on surgical bibliography. Brinton called him the most learned surgeon of his day. He was the friend and correspondent of Ollier and Esmarch, and of Adams, Gant, and Estlander. By reason of his contributions to surgery of the bones and joints, Otis ranked him with Billroth and Volkmann, and Gurlt and Legouest. F. R. Packard says he was the most learned man he ever knew.

Ashhurst succeeded Agnew as John Rhea Barton professor of surgery in 1888, when the latter retired from practice, and held the chair until his death. J. William White succeeded to the chair of clinical surgery, but Ashhurst continued his clinical teaching along with his didactic teaching. He was a firm believer in the value of didactic teaching. As a lecturer he was systematic, thorough, scholarly, always master of his theme and of himself, and while closely following the written page, his knowledge of surgical history and literature, and his wide clinical experience enabled him to illuminate his subject with a wealth of interesting comments. He had a fine gift of sarcasm when he chose to exercise it, which was but rarely in his public utterances.

As an operator he was deliberate, painstaking, and unruffled. He paid great attention to the after-treatment of his operative cases. He was a good gross pathologist. His great diagnostic ability and fine surgical judgment outshone his

reputation as a craftsman. But he was the best of plastic surgeons. Harte, his close friend and biographer, and himself a fine surgeon in this difficult field, ascribed Ashhurst's success in the complicated procedures of facial surgery to his taste for mathematics, which was one of his recreations.

The students feared him somewhat as an examiner, as he was a strict but very just and conscientious marker. They respected him greatly as teacher and man, and at a time when medical students were a rather turbulent body he remarked in his quiet way that he was never troubled with disorder in his classroom. To his assistants and internes he was dignified, but considerate and friendly, and often laid aside his natural Anglo-Saxon reserve with those he liked and trusted, and then revealed a keen if quiet humor which they greatly appreciated. As assistants, our devotion to him was unmeasured. He was entirely lacking in the smallness which sometimes impedes the upward progress of juniors in the profession. He was deeply interested in young men and their progress. Many there are of us who owe our start in surgery to his encouragement and influence.

Among his assistants who have passed were Harte, Wharton, Le Conte and G. G. Davis, while Deaver, Neilson, Howard Kelly, John G. Clark, Bloodgood, J. P. Hutchison, Girvin and Henry Norris are among those who were associated with him as assistants, or internes.

Steeped in the best traditions of the profession, he was an authority on the ethics of medical practice. While habitually reserved in manner he had withal a vivid human side, and a temper which, usually under firm control, could flame to a white heat at acts which he considered unprofessional, unjust, or dishonorable. The best revelation of his character is perhaps afforded by a perusal of the memoirs of his friends, James H. Hutchinson the internist, Wormley the chemist, and others, prepared for the College of Physicians, and in his addresses to students at opening exercises, commencements, and similar occasions. These are models of style, taste, and sympathetic insight.

With Ashhurst's training, position and tastes, it was natural that he should early assume a leadership in the councils of the College of Physicians, that unique medical society in Philadelphia whose traditions, methods of procedure, and control have been compared with those of the Royal College of Surgeons. One of the oldest medical societies in the country, and a very conservative body, it also possesses one of the largest medical libraries in the world, rich in incunabula, and other valuable editions, and a wealth of memorabilia besides. Osler took a deep and lasting interest in the College and its library, and said, while tracing its influence, "The social force and influence which physicians have always exercised in Philadelphia is not a little peculiar, and there is much truth in the statement that 'he is, and always has been, relatively a more important person here than elsewhere." To this influence the College has contributed in large measure. Ashhurst naturally turned to the College as one of his greatest interests. Long

influential in its Council, he succeeded J. M. Da Costa as president in 1898, only a few months before his final illness. He was one of the original Fellows of the American Surgical Association, and its vice-president in 1896. He was a vice-president of the Philadelphia Academy of Surgery, a president of the Pathological Society, and a member of the American Philosophical Society. He was an LL.D. of Lafayette College.

Ashhurst was a devoutly religious man, a prominent layman in the Episcopal Church, and a manager of the Episcopal Hospital. In his earlier life he was a keen book collector, and he possessed a large and valuable library, rich in medical and surgical works, medieval and modern, and in the classics, which he was fond of reading in the original tongues. Much of his medical library was devised by him to the College of Physicians. He married Sarah Stokes Wayne, of the same family to which General Anthony Wayne belonged, and of their seven children two studied medicine, the surviving one being Astley P. C. Ashhurst, the surgeon. Another son, John Ashhurst, 3rd, is the chief librarian of the Free Library of Philadelphia.

Doctor Ashhurst continued his practice and teaching until 1898, when he suffered a cerebral hæmorrhage resulting in hemiplegia, which incapacitated him for 2 years before his death. He died July 7, 1900. JOHN H. JOPSON.

TRANSACTIONS OF SOCIETIES

TOUR OF THE AMERICAN GYNECOLOGICAL CLUB, SUMMER OF 1926

To Germany, Denmark, Sweden, Norway, Scotland, and England

By FRANKLIN H. MARTIN, M.D., F.A.C.S., Chicago

THE pilgrimages to Europe which are being made by members of the medical profession of the United States and Canada for purpose of clinical observation may eventually become a strain on the hospitality of the European clinicians; but as yet there have been no evidences of this. On the contrary, the cup of welcome has always been full to overflowing with generosity. However, if we on our continent do not have an opportunity to reciprocate in kind to our friends of Europe, and demonstrate to them how well we are utilizing the information that they have so abundantly bestowed upon us, the time will come when our obligation to them will be too great. May we not become even a little sensitive by interpreting (if we were not already convinced to the contrary) this lack of reciprocation as being due to want of appreciation of the fact that we too are progressing, and that we too may have something of interest to show?

No one who has not made one or more of these trips to observe the work of his confrères abroad can appreciate the value of these visits in broadening one's views in regard to the work, the professional judgment, and the interpretation of results attained by any particular individual or groups of individuals visited. It is much more difficult to interpret character through the writings or reputation of a man than through a face-to-face, personal acquaintance. These travel observations are convincing evidence of fitness, honesty, and judgment in professional conduct. Oftentimes there is a demonstration of the difference between a well written romance and an accomplishment observed at first hand. To an Editor, a personal knowledge of the surgical work of an operator is paramount in evaluating the practical worth of a literary communication from a given source.

The "show me" spirit has been developed more and more in the conduct of medical societies of North America. It began seriously in 1903, when the Society of Clinical Surgery was formed. This was followed on a larger scale by the organization of the Clinical Congress of Surgeons of North America, in 1910. The American Gynecological Club came into being in 1911. These earlier efforts have been imitated in great numbers by inter-community visiting societies and inter-state clinical societies, some smaller and informal, and others larger and more formal with a broader range of travel. Among the latter a conspicuous example is the Tri-State District Medical Association, more recently known as the Inter-State Post-Graduate Assembly of North America.

In 1911, a few months in advance of the organization of the American Gynecological Club, the obstetricians and gynecologists of England, Scotland, Ireland, and Wales organized the Gynecological Visiting Society of Great Britain, which, up to the present time, has confined its visits to the British Isles. However, tentative plans now under way forecast the initial bow of this society on foreign territory through a visit to Canada and the United States during the summer and autumn of 1927. It is to be hoped that our visitors may find here much that will interest them, and I predict that the reception which will be accorded to them will repay this distinguished group of men for making what appears to them such a huge effort and such a long journey—a long journey that appears, when taken by us, so short, so delightful, and so worth while.

The success of a trip for clinical study is dependent, in a great degree, upon carefully laid plans which will not attempt too much and which will give time for observation and for recreation. The itinerary should be discussed well in advance by the different members of the group; and the details of working out schedules, obtaining accommodations, and perfecting arrangements for sightseeing should be put into the hands of a reliable travel company which will furnish an intelligent courier to protect the travelers from all annoyances of customs which are foreign to them. Extensive advance correspondence with the clinics

to be visited, obviously, is necessary, as no clinics or clinicians should be included in the advance program from whom a cordial invitation has not been received.

On three occasions the American Gynecological Club has visited Europe and the British Isles: In 1912, France, Germany, and Austria; in 1914, France, Switzerland, Germany, Scotland, and England; and in 1926, Germany, Denmark, Sweden, Norway, Scotland, and England. As a rule the men were accompanied by their wives and other members of their families, and this undoubtedly has proved a great factor in the success of the tours.

OUR ITINERARY

Early on the morning of June 29, 1926, the American Gynecological Club sailed from New York on the SS. *Resolute* of the United American Lines. Our table seats and deck chairs had been reserved. Our trip across the Atlantic was without incident, aside from the extreme enjoyment of a reunion and comradeship of a group of old friends with whom we had adventured to Europe at least twice before.

We were due to arrive in Duxhafen and take a train for Hamburg (one and a half hours away) immediately upon disembarking. Hamburg gave us a glimpse behind the curtain of Germany since it was rung down after the tragedy of war. It was much as before, with apparently the same efficiency of operation and normal prosperity.

Hamburg, Germany, July 8 and 9
Copenhagen, Denmark, July 10, 11 and 12
Lund, Sweden, July 13 and 14
Stockholm, Sweden, July 15, 16 and 17
Gota Canal, July 18, 19 and 20
Gothenburg, Sweden, July 21
Oslo, Norway, July 23 and 24
En route to Myrdal, July 25
En route to Flaam, Gudvangen, and Voss, July 26
Voss, Norway, July 27
Bergen, Norway, July 28
Crossing North Sea, July 29.
Newcastle-upon-Tyne, Scotland, July 30
En route by automobile to Edinburgh, July 31
Edinburgh, Scotland, August 1 and 2
Through the Trossachs, August 3
Glasgow, Scotland, August 4
Liverpool, England, August 5 and 6
Disbanded in Liverpool on August 7.

OUR HOSTS

Because of our past experiences, we anticipated a cordial reception, but our expectations were excelled everywhere. Our program, as arranged in advance, was most attractive, but it was a mere outline that was amplified in each case as we finally enjoyed it. Everywhere attractive social entertainments were planned to emphasize local color, in the daytime for the ladies in particular, and in the evenings for our entire group.

Hamburg. While there was no advance program for our brief stay in this city, we were agreeably surprised to find invitations awaiting us from Professor Th. Heynemann, Professor E. F. Mueller, Professor Schottmueller, and Dr. Bilrich, who received us, made us welcome, and particularly pleased us by their selection of operations.

Copenhagen. Among our hosts were Professor S. A. Gammeltoft, Dr. Otto C. Aagaard, Professor E. Hauch, Professor E. Ehlers, Dr. C. Wessel, Dr. Grubdal, Professor O. Chievitz, Dr. I. P. Hartmann, and Dr. Fenger-Just.

Lund. Professor E. Essen-Möller.

Stockholm. Professor Hj. Forssner, Professor E. Ahlström, Professor Dr. James Heyman, Professor E. Bovin, Professor Einar Key, Dr. G. Holmberg, Professor Dr. Gösta Forssell, Dr. Berven, and Dr. Wetterdal.

Gottenberg. Dr. Mannheimer, Dr. H. Benckert, and Dr. Hellström.

Vernamo. Dr. Torsten Rietz.

Oslo. Professor Kr. Brandt.

Bergen. Dr. L. Severin Petersen.

Edinburgh. Professor Benjamin P. Watson, Dr. A. H. Freeland-Barbour, Dr. W. Fordyce, Dr. J. Haig Ferguson, Professor R. W. Johnstone.

Glasgow. Professor J. M. Munro-Kerr, Professor S. Cameron, Dr. James Hendry, Dr. Hewitt, Professor J. H. Teacher, Dr. David Shannon, Dr. J. N. Cruickshank, Dr. Donald McIntyre, and Dr. Lennie.

Liverpool. Professor W. Blair Bell, Dr. Leith Murray, Mr. A. Leyland Robinson, Professor R. E. Kelly, Dr. Cunningham, and Mr. Woolfenden.

SUMMARY

When serious observers are privileged as guests to visit for three weeks the hospitals, operating rooms, laboratories, universities, and teaching halls of honest contemporaries in a foreign land, how meager is our ability to describe the experience in a way to interest a reader and to put him in the same sympathetic and admiring attitude toward each and every one of our hosts! We have been the welcome guests of some of the great teachers of the world. They have taken us into the very heart of their work, with great modesty and without apology, and they have said to us: "This is our way; these are our reasons; these are

our patients; these are our methods; and these are our results." If we found that the means to a common end were different from our own work in some unimportant details, we also found them different among men of the same countries, or even among men of the same cities. What we did find was that every day we were learning something in a way that could never be equalled by the perusal of books. I doubt if there was one of us who was prompted to make invidious comparisons. Every hour of every day we realized that we were privileged students because we were given opportunity for a face-to-face discussion with our teachers of the points at issue; we were privileged to see with our own eyes what they were doing and to hear with our own ears what they had to say. And this invaluable privilege need not be unique; it is open to all serious minded seekers after the truth. The one sad feature that haunted us was the fact that our hosts do not manage to do unto us what we have done unto them. This was not prompted by a feeling on our part that we may have something different to show them, but by a desire to reciprocate by showing them what we have. The scientific world is becoming more uniform, more crystallized, and its methods more standard. While literature, of necessity, promotes, records, analyzes, and preserves in permanent form the work of a surgeon, the casual interchange of ideas in his workshop must result in a better understanding.

We have the promise of visits to America within the near future of several outstanding teachers of Scandinavia. There can be no doubt as to the welcome they will receive; nor can there be doubt of the pleasure that we shall derive from making them feel at home. We have a definite promise of an early visit of the Gynecological Visiting Society of Great Britain. For them all we will, with the aid of our Canadian confrères, polish up our best English and open wide our doors.

OUR PARTY

The names of the members of the American Gynecological Club who were with us on this occasion, and our invited guests, are appended below. It must be admitted that not the least important factor of the success of our organization (and I believe of any sane organization) was the fact that we were accompanied by our wives and other members of our families. Too great emphasis cannot be placed upon the great pleasure it was to all of us to have with us throughout our visit several of our grown children. I say "ours" because they were christened the "daughters" and "sons" of the Club. Their presence warmed our blood and enhanced our happiness. They were Mary Osborn Polak, Dickie Smith, Katherine L. Kosmak, George W. Kosmak, Jr., Burton W. Taylor, and David Newton Danforth.

The *esprit de corps* and the intimate good-fellowship of a large family that develops in one of these long trips is not the least valuable feature of this form of travel. Our more conventional hosts frequently remarked upon our intimacy of contact, and our custom of calling each other by our given names. This, we assured them, was not a pose, but the promptings of a close friendship, akin almost to family intercourse. To most of us, I believe, the formation of these close friendships is the unending asset of our association.

J. Wesley Bovée, Washington, D. C.
Joseph Brettauer, New York
William E. Caldwell, New York
Robert L. Dickinson, New York
N. Sproat Heaney, Chicago
Barton Cooke Hirst, Philadelphia
Frederick C. Holden, New York
J. M. Munro Kerr, Glasgow
George W. Kosmak, New York
Herbert M. Little, Montreal
Franklin H. Martin, Chicago
C. Jeff Miller, New Orleans
Reuben Peterson, Ann Arbor
John Osborn Polak, Brooklyn
Frank F. Simpson, Abroad
Richard R. Smith, Grand Rapids
Howard Canning Taylor, New York
George Gray Ward, New York

CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD MARCH 19, 1926, DR. DAVID S. HILLIS PRESIDING

ABSCESS IN RIGHT HORN OF UTERUS; AND OVARIAN DERMOID ROTATED AND FIXED BY OMENTAL ADHESIONS.

DR. CAREY CULBERTSON: The specimen presented is one of intramural abscess in the right horn of the uterus, developing about the interstitial portion of the tube. The patient was a young woman 30 years of age. I have not noted such a finding in over 800 cases of salpingitis operated upon.

The specimen of ovarian dermoid was taken from a woman, age 36, who came into the hospital complaining of severe pain in the right side of 3 weeks' duration. This patient had been operated upon some years earlier and then again in 1923 for gall-bladder drainage. At the second operation, as far as could be ascertained, a drainage and not a cholecystectomy was performed. When the patient was admitted to the hospital, the pain was so severe that she could not stand up straight and it was accompanied by a pulling and dragging sensation. She was obese and not easy to examine, but the right side was extremely tender. A small fibroid of the uterus was palpated. A fixed, tender mass, about the size of a grapefruit, could be felt in the ileocæcal region. At operation an ovarian dermoid cyst, the pedicle of which had been rotated one and one-half times, was found on the right side. The omentum was densely adherent in the right upper quadrant and over the upper portion of the dermoid cyst, thus fixing it firmly in its twisted condition. The sigmoid flexure, the cæcum, and a loop of ileum were likewise adherent.

SQUAMOUS CELL CANCER OF THE CERVIX

DR. CARL HENRY DAVIS: Mrs. M. L., aged 24, married 2 years, came in March 6, 1926, because of sterility. Her periods began at the age of 14, were always regular, of the 28-day type, and lasted about 5 days with moderate flow and with slight cramps the first day. The last period occurred two weeks previously. The immediate family history was negative except that a maternal aunt died of cancer of the breast at the age of 32 and the patient's twin sister had been operated upon for exophthalmic goiter 4 years ago. She had no abdominal or pelvic pain, but had been constipated since an attack of intestinal "flu" last summer. There had been a slight vaginal discharge for several months with a definite increase since the first of the year. Napkins were not needed. Her usual weight since marriage had been 100 but on examination it was 94½ pounds. The height was 5 feet 3 inches.

Physical examination showed head and mouth negative. There was moderate, uniform enlargement of the thyroid. The lungs were negative. The heart was not enlarged but had a systolic blow over the base. Breasts and abdomen were negative.

Vaginal examination showed external genitalia negative. The hymen would admit only one finger. Under nitrous oxide and ether anæsthesia the hymen was dilated. The cervix had a small growth about ½ centimeter in diameter protruding from the right side of the cervical canal. The uterus was retroverted but normal in size. The adnexa were negative. The irregular growth was removed for microscopic examination and the base cauterized with the electric cautery. The pathological diagnosis was squamous cell cancer of the cervix.

The patient was sent to Columbia Hospital and a panhysterectomy was performed March 12, 1926. On the right side the ureter was exposed and lymph glands removed with the parametrium. On the left side the dissection was less extensive as the growth was entirely on the right side. The pathologist's report on the tissue removed at the time of operation was as follows:.

"Region of cauterization is bare of epithelium and shows in places superficial coagulation necrosis with slight leucocytic infiltration. The superficial tissue also shows mild œdema. At one edge of the defect the squamous epithelium stops rather suddenly as at an ulcer edge and is practically normal in appearance. Lymph nodes show mild chronic inflammation in the form of enlargement of cells of reticulum or lining lymph sinuses. The cells are large and pale and have not the appearance of tumor cells."

DEATH IN A PREGNANT WOMAN DUE TO A RETROPERITONEAL RUPTURE OF A SMALL ANEURISM OF THE SPLENIC ARTERY

DR. W. C. DANFORTH: Patient was 28 years of age and was in the seventh month of her second pregnancy. She was delivered 2 years previously by the author without incident. One afternoon about 3:30 her blood pressure was 110. About 6:30 the same afternoon she suffered severe abdominal pain. She was seen 20 minutes later and presented all the signs of hæmorrhage with acute anæmia. The area over the uterus was quite tender to pressure. At first glance one would think of a separation of the placenta, but the physical signs of this were absent and the child was alive. She was brought to the hospital, given morphine, and kept quiet.

During the night she had another attack of pain, and the following morning was intensely anæmic. There was still no change in the size of the uterus. It was thought that possibly she might have had a separation of the placenta but with less hæmorrhage than ordinarily would produce such intense signs of shock. It was apparent that the child was dead, and the uterus was rapidly emptied. No hæmorrhage was found. Transfusion was done. She rallied for a few hours but by night became rapidly worse and died.

The autopsy showed the cause of death to be a retroperitoneal rupture of a small aneurysm of the splenic artery, with an enormous retroperitoneal hæmorrhage.

ABSENCE OF THE UTERUS

DR. W. E. NEWMAN DORLAND: The patient, 23 years of age, had been married 13 months. She had never menstruated. On examination I found the woman apparently normally developed, with a full growth of axillary and pubic hair. The breasts were perfectly developed. She had what appeared to be a vagina large enough to admit the little finger. There was no urethral orifice visible in the genitalia. Examination showed a small urethral orifice midway on the anterior wall of this so-called vagina, out of sight but to be felt within. Rectal examination showed a complete absence of the pelvic viscera and uterus. The abdominal and rectal fingers came in contact without any trouble. I believe ovaries were present. The patient stated that she had a desire for the marital relation but there was absolutely no satisfaction. There was no clitoris.

This case comes under the group of absence of the uterus. The opening of the urethra on the anterior wall of the small canal was of interest.

PREVENTION AND RELIEF OF PROLAPSUS UTERI

DR. ROLAND S. CRON of Milwaukee, Wisconsin, read a paper, by invitation, entitled, "Prevention and relief of prolapsus uteri." (See page 698.)

DISCUSSION

DR. C. W. BARRETT: As a primary cause of prolapse of the uterus we have the unfortunate fact that women walk on their hind legs in an upright position with the genital opening the lowest part of the abdominal cavity. Four-footed animals have no such tendency to prolapse, though with the bad position of farm animals there is a light tendency for them to have prolapse. In the male the lower wall of the abdomen is much better taken care of. In the female it is fairly well taken care of were it not for the fact that childbirth comes along and displaces these structures. Once in a while there is a woman with a prolapse who has not had a child. As the head has to pass into this narrow space, the levator ani, instead of being a help to childbirth as the older obstetricians taught, is decidedly in the way. That is, of course, recognized more in episiotomy. I have not found episiotomy so entirely satisfactory in the repair, but since exposing the muscle that is torn and uniting it definitely, as we would in a gynecological operation, I have been much more satisfied with the pelvic floor repair.

In exposing those muscles for repair we are doing just what we do in any wound. The muscle is practically always injured to some extent. It is either extremely dilated, elongated or torn, or both, and we do not expect it to be quite as good for support as it was before. If it is not good for support it should be repaired. If it has not been badly injured a good deal depends on the innervation. I think we would see much less prolapse if we got a good innervation of the pelvic muscles.

When it comes to repair of the pelvic wall there are certain conditions that must obtain. We must make a good pelvic floor support and not something on the posterior vaginal wall. The muscles of the pelvic floor still have their circumference attachment but they lack the attachment between the rectum and the vagina. We must have the vagina in about a perpendicular line. We must do away with any redundancy of the vaginal wall.

It is not difficult to cure a moderate prolapse by having the uterus on top of the bladder. All we have to do is to have it out of alignment with the vagina. If we can keep the uterus from going down by planting it in between the bladder and vagina, we can get a larger percentage of good results by having it in the normal relation of the body. There is a great advantage in having the uterus in a normal position above the bladder free to undergo the enlargement of childbearing. In women who have passed the childbearing period, the larger number would be better if the uterus were taken out. There seems to be a false idea that the bladder is going to support the uterus and the uterus is going to support the bladder. Neither one of them is a supporting structure. If we take the uterus out all those ligaments go back into the abdomen and leave the vagina unattached and we have increased the patient's chances of having a falling of the vagina and bladder. If we take the uterus out and use the ligaments that we detached from the uterus to attach to the vagina, we lessen the tendency to prolapse.

DR. W. MCI. THOMPSON: The interposition operation is fine in selected cases for women who have passed the childbearing period. This operation will easily block the prolapsing vagina.

DR. W. C. DANFORTH: Follow-up examinations show that a properly done episiotomy is a conservative and very useful procedure. It is not useful, however, unless one sections some of the muscle which is going to be injured, that is, the muscular tissues of the pelvic floor. We must section them so as to get enough room for the head to come through, so that further tearing does not occur. The recognition of the structures that have been sectioned is not difficult nor is the re-uniting at all difficult.

My own experience with the interposition operation in properly selected cases has been exceedingly satisfactory.

Another procedure which he did not mention and which emanated from the same source as the interposition operation, namely Dr. Watkins, is the use of the lower portion of the broad ligament which may be advanced on the lower part of the uterus. Many of our cases are handled very satisfactorily by this technique.

DR. CAREY CULBERTSON: Procidentia uteri is seen most frequently in two types, the thin, undernourished, long-waisted type and the soft flabby type. While episiotomy is very advantageous in certain cases, I do not believe that it will prevent procidentia subsequently in women of these types, if they go on having children. In other words, I follow Dr. Cron in his emphasis upon the type as being the determining factor, the obstetrical factor being of second importance.

As an operation for cystocele it is extremely satisfactory. The chief criticism that I would make of the report is that there were 225 of these operations in 225 cases but we are not to assume, of course, that this is the only operation that was performed for procidentia. I do not employ the Watkins operation when the uterus comes out of the vagina. Not every uterus can be handled in this way. Some are too large, either from the presence of fibroids or from subinvolution; some are too small. Sometimes in a senile woman the atrophy is so great that the organ is of no value for the operation. If the uterus is not too small or too large for cystocele, transposition has been found to be a very satisfactory operation indeed.

There is another operation which was not mentioned that is very satisfactory in elderly women and that is the one devised by LeFort in which the anterior and posterior vaginal wall are denuded and sutured together. The operation is extremely simple and can be done under local anæsthesia or ethylene gas and is attended with very mild, if any, reaction.

DR. CARL HENRY DAVIS: Dr. Cron has followed up 225 interposition operations performed by 13 different men. There was a total mortality of 2, which is less than 1 per cent. The average age of the patient was 54, there were a number of patients who were approaching 70, and 2 who were past 70. I do not know of any other operation for the types of conditions listed which could have been performed with as low a mortality and certainly none with as satisfactory results.

As far as the third degree prolapse cases are concerned, I would agree with Dr. Culbertson, Dr. Baer, and Dr. Danforth in regard to those elderly women with very small uteri. With the larger uteri, I would beg rather to differ for the simple reason that we can reduce the uterus to such a size that it will act as a tampon to the supporting structure. I performed 13 operations in the group reported, and 2 of the most satisfactory were on patients with complete eversion of the vagina, both with very large uteri. One was a woman whose muscles were so flabby that had the uterus been removed I do not believe that any other operation, including that suggested by Dr. Culbertson, would have kept everything from pushing down. However, by a reduction in the size of the uterus, by interposition, and by building up of a good perineum, it was possible to get a satisfactory result. The other patient was a very large woman. Some 4 inches of the cervix were removed, and 2 years after operation the uterus was as large as that of a multiparous woman. The day after this patient got home from the hospital she ran a half block carrying her 9-year old daughter who had been run down by an automobile. Later she showed some evidence of high rectocele. This was subsequently repaired by a secondary operation.

DR. C. S. BACON: Dr. Cron spoke of prevention and mentioned only episiotomy. I presume he did not mean to convey the impression that that was the only thing that could be done to prevent prolapse. I think attention should be called to the fact that proper management of both the first and second stages of labor is of the utmost importance. Episiotomies in 53 per cent of normal labors is a large number. Dr. Davis has said that in his experience only 1 of a large number of cases failed to heal. I would like to know if Dr. Cron can give the same report. I think among ordinary operators the percentage of failures would be very much greater than that. I am not at all sure but that proper repair, even after a small laceration, can be done just as well as an episiotomy. Episiotomy is desirable occasionally to prevent the tearing of the vulvar opening and very frequently involves only the accessory muscular tissues of the vaginal outlet, namely, the bulbocavernosi and the transversus perinei and does not involve the puborectal or pubococcygeal muscle. Here we usually have no difficulty in the repair. Much more important is the more extensive operation in which the branches of the levator ani are cut. This can often be avoided by patience. Spontaneous dilatation of the vagina by stretching these muscles will generally occur.

I do not believe that such a large percentage of cases of episiotomy need or would represent the practice of the average obstetrician.

DR. R. S. CRON (closing): I was very much interested in Dr. Barrett's discussion on repair of the perineum in preventing prolapse of the uterus; but I think that he has lost track of the fact that there are many patients who develop cystocele and prolapsus when no repair has been done or even in spite of an immediate repair. It is in these cases that we find it necessary to do some such operation as the Watkins operation. When such anatomical reconstruction can be done, I think it is very desirable. I wish all men knew anatomy as well as Dr. Barrett does.

In regard to Dr. Danforth's remarks on the limitations of this operation, I will grant that there are many cases in which the Watkins operation should not be performed. As you know, the failures were proportionately greater in women with third degree prolapse, especially when the prolapsed uterus was small and atrophic. I feel as the majority of men do that for this type of condition the use of the Watkins operation should be limited to moderate or first or second degree prolapse with cystocele. We have frequently used some of the other methods which necessitate removing the uterus and anchoring the base of the bladder and top of the vagina to the cardinal ligaments. I did not wish to convey the impression to Dr. Danforth that I think the round ligaments are supporting structures. They merely direct the uterus.

In our experience practically all episiotomized perineums heal by primary union. I do not think that we have ever tried to cut the deeper structures of the pelvic diaphragm. The incision usually includes the skin, the urogenital septum or fascia, the constrictor vaginæ, transversus perinei, and the anterior fibers of the levator ani. Because of the excellent results we have obtained I feel that in the future we will do even more episiotomies.

PITUITRIN AT THE BEGINNING OF THE THIRD STAGE OF LABOR. A CRITICAL REVIEW OF TWO THOUSAND CASES

Dr. Russell Scott read a paper entitled, "Pituitrin at the Beginning of the Third Stage of Labor. A Critical Review of Two Thousand Cases." (See page 651.)

Dr. C. S. Bacon: When there is no sign of separation of the placenta from the uterus the personal equation comes in as the most important element in determining interference. If these cases were all managed by the same person we could better compare the results. I was surprised that expression was used uniformly in all cases. I do not know that we can accept these statistics quite at the face value on account of that personal element. One cannot make an expression of the placenta satisfactorily unless the uterus is contracted. Pituitrin makes a quicker contraction and can be followed by expression. That may be desirable if it really diminishes the amount of hæmorrhage. I suppose it does make a little difference whether a woman loses 50 or 100 cubic centimeters of blood though a loss under 200 cubic centimeters is not generally of great importance. If those cases would terminate normally within 15 to 30 minutes without pituitrin, it probably should not be used. When there is a delay, pituitrin should be used. Its uniform use in all cases is questionable practice.

The number of manual removals of the placenta was 22 and 27 per thousand. That is a large number. In my student days under Jaggard he used to say that there were two manual removals in one thousand cases in Karl Braun's clinic. After I had had 2 manual removals in my first 3 cases in the County Hospital I realized that I must have 997 cases without this complication; and I learned that proper management and proper expression sufficed in nearly all cases except those of placenta accreta.

Dr. W. C. Danforth: Dr. Scott's figures bear out the impression which I have had from clinical observation, that the third stage of labor is materially shortened by the use of pituitrin at the end of the second stage. It has been my impression also that the amount of blood loss since we have been using pituitrin has been distinctly less. As regards the case in which incarceration of the placenta occurred, this woman was a patient of mine. Some years ago, too long ago to have been included in Dr. Scott's statistics, I delivered this woman for the first time. At that time we were not using pituitrin routinely at the end of the second stage. Incarceration of the placenta occurred, requiring the use of ether to bring about sufficient relaxation for extraction. The same woman therefore had the same complication with and without the use of pituitrin.

The only completely accurate figures that I know of on the amount of blood lost during labor, are those of a German observer who obtained the figures by conducting labors on a bed with a hole in the middle under which, in a receptacle, all blood lost might be collected.

Dr. Henry W. Lewis: I think there might be devised a method of getting a fair proportion of the blood by catching it in some sort of a vessel. Dr. Barrett suggests using gauze pads. It seems to me there is a great chance of error in that way. The personal equation is so great, that, if a large number of people are engaged in the work, a method should be devised that would give a more accurate estimate.

Dr. J. L. Baer: Heretofore I have treated placental removal as Dr. Bacon does. If I understand the essayist, there was routine placental expression. In most cases the placenta separates very readily after the completion of the second stage. If the uterus is allowed to retract in due course there is a simple expression. Pituitrin renders the uterus hard for a time, the obstetrician concludes that separation has occurred and he goes ahead with the expression. This is a questionable point that I think the essayist would like to discuss further. My own experience with pituitrin has been that when I have given it early after the termination of the second stage it seemed sometimes as if the placenta had become involved in the contraction of the uterus which held it rigidly in the lower uterine segment. In other words, if I give pituitrin in the third stage it is as a prophylactic against hæmorrhage rather than to hasten the expulsion of the placenta.

Dr. Scott (closing): I am very willing to admit that the amount of blood is apt to be wrongly estimated. This paper is a review of 2,000 cases and all the cases were not delivered by the men on the active staff of the Evanston Hospital. There were on an average 12 men delivering there. I think the operative percentages might not be the same if the work was all done by staff members.

I think Dr. Hillis has said that shortening the third stage of labor after operative delivery is a great advantage. The patient is the one we have to think about. If the patient is back to bed that much sooner after an operative delivery she is in that much better condition.

TROTVLAE CVRANDARVM AEGRITV-
DINVM MVLIEBRIVM, ANTE, IN, ET POST
PARTVM LIBER VNICVS, NVSQVAM ANTEA

editus, quo fœminei ſexus accidentes morbi & paſſiones, infantum & puerorum à partu cura, nutricis delectus, ac reliqua iſtæ adnata, diſpoſitiones utrique ſexui contingentes, experimenta denique uariarum ægritudinum, cum quibuſdam medicamētis decorationi corporis inſeruientia, docentur.

PROLOGVS.

CVM auctor uniuerſitatis DEVS in prima mundi conſtitutione, rerum naturas ſingulas, iuxta genus ſuum diſtingueret, naturam humanam ſupra cæteras creaturas ſingulari dignitate concidit. Huic enim, ſupra aliorum animalium conditionem, rationis & intellectus libertatem dedit. Propterea uolens eius generationem perpetuo ſubſiſtere, in ſexu diſpari, maſculum & fœminam creauit, ut eorum fœcunda propagatione nunquam deſineret emergere futura ſoboles. Quorum quidem cōplexiones grata quadam commixtione contemperans, naturam maſculi calidam & ſiccā, fœmellæ uero frigidam & humidam conſtituit: qua cuiuſque alterius complexionis exceſſus, mutua qualitatum cōtrariarum repugnantia coerceretur: adeo, ut uiri conſtitutio calida & ſicca, mulieris frigiditatem & humiditatem: & econtra huius natura frigida & humida, illius complexionem calidam & ſiccam remulceret. Similiter ut maſculus qualitate fortiori dignus, in mulierem tanquam in agrum ſemen effunderet, & mulier qualitate debiliore prædita, tanquam uiri officio ſubdita, ſemen effuſum in gremium natura ſuſciperet. Quoniam ergo mulieres natura ſunt uiris debiliores, hinc eſt quòd in eis ſæpius abundant ægritudines, maxime circa membra operi naturæ debita. Quæ cum in loco ſecretiori accidant, ipſæ propter uerecundiam, & conditionis fragilitatem, non audent anguſtias ſuarum ægritudinum medico reuelare. Quapropter ego, miſeranda illarum calamitate, præſertim cuiuſdam matronæ inſtigatione, cōpulſa, incepi diligentius contemplari de ægritudinibus, quibus fœmininus ſexus ſæpiſſime moleſtatur. Cum itaque in mulieribus non tantus abundet calor, qui prauos & ſuperfluos, qui in eis quotidie congregantur, ſufficiat cō ſumere humores, nec tantum laborem ualeat earum debilitas tolerare, ut fudorem poſſit ad exteriora illos natura expellere, ſicut in uiris: ideo ipſa natura, propter defectum caloris, eis præcipuam quandam purgationem deſtinauit, ſcilicet menſtrua, quæ uulgus flores appellat. Nam ſicut arbores non producunt ſine floribus fructus, ſic mulieres ſine proprijs floribus, conceptionis officio defraudantur. Hæc autē purgatio contingit mulieribus, ſicut de nocte uiris pollutio. Semper enim natura grauata quibuſdam humoribus, ſiue in uiris, ſiue in mulieribus, iugum ſuum nititur deponere, & laborem minuere. Solet præterea huiuſmodi purgatio mulieribus contingere circa decimumtertium, uel quartumdecimum annū, uel paulo citius, uel paulo tardius, ſecundum quòd in eis magis, uel minus abundat caliditas uel frigiditas. Durat autem uſque ad quinquageſimum annum, ſi eſt macra: quandoque uſque ad ſexageſimum, aut ſexageſimumquintum, ſi eſt humida: in mediocriter pinguibus, uſque ad quadrageſimumquintum. Si autem debito tempore & ordine contigerit talis purgatio, exonerat ſe cōpetenter natura à ſuperfluis humoribus. Si uero menſtrua plus uel minus exierint, quàm debent, plures ægritudines inde emergunt. Quoniam inde minoratur appetitus tam cibi, quàm potus. Quandoque fit uomitus: & quandoque appetunt terram, carbones, cretam, & ſimilia. Quandoque ex eadem cauſa dolor ſentitur circa collum, dorſum, & in capite. Quandoque adeſt febris acuta, cordis morſus, hydropiſis, uel dyſenteria. Hæc autem contingunt, uel quia tempore longo deficiunt menſtrua uel quia prorſus non habent: unde non ſolum hydropiſis, uel dyſenteria, uel morſus cordis accidunt, ſed & alię peiores ægritudines. Aliquando enim accidit diarrhœa, propter nimiam frigiditatem matricis: uel quia uenæ eius ſunt multum graciles, ut in extenuatis mulieribus: quia tunc humores ſpiſſi & ſuperflui non habent liberos meatus, per quos poſſint erumpere: uel quia humores ſunt ſpiſſi & uiſcoſi, ideo propter conglutinationem, eorum exitus impeditur: uel quia delicioſe comedunt: uel quia ex aliquo labore multum ſudant. Sicut teſtatur Galenus. Mulier quæ ſe nō exercet multum, neceſſe eſt, quòd abundet in multis menſtruis, ad hoc ut ſana exiſtat. Aliquando mulieribus deficiunt menſtrua, quia in corpore earum coagulatus eſt ſanguis: uel quia ſanguis per alia loca emittitur, ut per os, aut per nares, per ſputum, aut hæmorrhoides. Aliquando deficiunt menſtrua ex nimio dolore, uel ira, uel motu, uel timore. Si autem diu ceſſauerint, ſuſpicationē grauis ægritudinis futuræ arguūt. Nam urina eorum uertitur in ruborem, uel in colorem loturæ carnis recentis: quandoque in uiriditatē, uel liuiditatem, aut in colorem, qualis eſt color graminis, facies earum mutatur.

THE SURGEON'S LIBRARY

OLD MASTERPIECES IN SURGERY

By ALFRED BROWN, M.D., F.A.C.S., Omaha, Nebraska

TROTULA, THE DISEASES OF WOMEN

THE very name of Salerno calls to mind the picture of medicine and surgery struggling to regain their lost prestige in Continental Europe. To it came Constantine, the African, driven from Carthage by the threats of his enemies, bringing with him the knowledge of the Arabians. The city had been founded by the Romans many centuries before Constantine, and had become famous as a health resort and a shrine for pilgrims, for its cathedral held the bones of St. Matthew and the relics of the saints Thecla, Susanna, and Archelaïs. It was only natural that it should become the site of a school and in 802 A.D. one is thought to have been founded there by Charlemagne who was so active in trying to re-establish learning in Europe. This school was probably kept up by the Normans during the period of their rule in lower Italy, so by the ninth century Salerno had become one of the greatest universities on the continent. Because of its value as a watering place it was natural that medicine should be taught there and finally the "Collegium Hippocraticum" or Hippocratic College was formed to teach medicine. Among the earliest teachers were four men: a Jew, Helinus; an Arabian, Adala; a Greek, Pontus; and a Roman, Magister Salernus. Each of these taught students of his own race in his own tongue. But before this there was a well-known family, Ruggerio, in Salerno, which furnished many important citizens to lower Italy and finally from it there sprang the most famous woman of all early medical history. One must bear in mind that at this time medical practitioners of the male sex were restricted in their treatment of the opposite sex to generalized diseases and anything pertaining to disease of the generative organs, even obstetrics, was out of the province of the male physician. Hence the midwife was supreme in that field and it only remained for one of those who were known generally by the name of the Women of Salerno to make for herself a lasting name in medicine. This opportunity was grasped by a woman named Trotula. The exact time when *the* Trotula, for the name continued for centuries among the women of Salerno, lived is not certain. Her work appears in the Venetian Collection *Medici Antiqui Omnes, etc.*, under the title "The First Book of Trotula Concerning the Cure of Diseases of Women, Before, During, and After Delivery, etc."[1] It is probable that she lived during the eleventh century and wrote her work before the arrival of Constantine for nowhere does she mention the Arabians in it. This is of course a matter of conjecture only, but the account of De Renzi in his *Scuola Medica di Salerno* setting the date of Trotula as during the time of the last Prince Longobardo but before the arrival of Constantine seems to be worked out logically and appeals to one as probably correct. According to him, Trotula was the wife of a physician, John Platearius the elder. That she was well known and equally well regarded by the men of her time is shown by the statement of one of the famous physicians of the eleventh century, Rodolpho Malacorona, who in the year 1059 said he did not find in Salerno one who could equal him "praeter quamdam sapientem matronam" except a certain learned matron who could have been none other than Trotula.

The most important work of this woman from the standpoint of surgery is the *Diseases of Women* noted above. In the Latin reprint it covers ten folio pages, beginning with a prologue in which she discusses the creation of the world (a common custom of beginning a book in those days, to go back to the creation as a starting point) and the creation of man and woman with an elaboration of their different characteristics and functions. Then comes the body of the work which treats of gynecological conditions in more or less textbook style. This begins with the various abnormalities of the menstrual flow and proceeds to displacement of the uterus and finally to the consideration of the puerperal state, with its complications, etc.

Then, as now, efforts were made to prognosticate the sex of the fetus with about equal success in both periods. Trotula had a rule which she states thus: "In order to know whether the woman will bear a boy or a girl, take water from a spring, and draw two or three drops of blood or milk from the right side of the woman and drop them into the water; if they sink she will bear a boy; if they float, a girl."

The work bears its greatest importance in that it contains the first known description of perineorrhapy. This is advised for complete tear "in which the vulva and anus make one foramen." Three or four silk sutures are inserted to draw the parts together. The wound is dressed and the patient put to bed with her feet higher than her head. There she remains for eight or nine days, after which she gradually resumes her duties.

[1] Courtesy Dr. LeRoy Crummer, Omaha, Nebraska.

REVIEWS OF NEW BOOKS IN SURGERY

IN a book called an introduction to the subject of X-rays and radium[1], the elements of the physical and chemical phases of radio-activity and radiology are presented in a manner suitable for use by students and others desiring an academic understanding of these agents. The construction of X-ray apparatus and the tubing of radium and radon seem overemphasized to the American reader. The treatise supplies information leading up to the practical use of both. Discussions of the theories of radio-activity, the theory of atoms, and the biological effects of X-rays and radium rays are well set forth.

A. J. LARKIN.

DEAVER'S *Surgical Anatomy*,[2] known so widely and favorably for 25 years, now appears in a second revised edition. The actual text matter remains much as before although there is some rewriting and recasting of descriptions especially as this is necessitated by a new sequence of presentation; the account of the brain has been altered more than any other topic in the first volume. A certain degree of elegance is lost in the plates by the abandonment of the former buff background frames; it cannot be said, however, that the illustrations are perceptibly weakened in teaching value, unless, as is possibly the case, an artistic effect enlists a sympathetic attitude.

There are two chief changes of policy in the new edition. The first is the introduction of the B. N. A. terminology—the English equivalents are inserted within parentheses following the primary use of the old terms. The second change involves a rearrangement of the text into a more logical and useful sequence; the first volume now comprises the surgical anatomy of the head, including the brain, face, mouth, nasopharynx, eye, and ear; the second volume will cover the upper and lower extremities, the neck, shoulders and back; the third volume will treat of the chest, abdomen, pelvis, and perineum. The material is thus far more accessible than formerly. This work will continue to be a standard reference for the prospective and practising surgeon.

L. B. AREY.

COKKINIS[3] has prepared a monograph which embodies the results of a research on the subject of mesenteric vascular occlusion which occupies a decidedly unsatisfactory place in surgery. The work is based upon anatomical study in cadavers, experimental ligature in animals, and the study of the records of 76 autopsies. The subject is covered with a completeness of detail not ordinarily found in surgical texts.

In the summary the following facts are emphasized: Vascular occlusion is not an extremely rare disease. An obvious etiological factor plus the presence of an atypical obstruction associated with internal or external hæmorrhage should usually suggest the diagnosis. With earlier and bolder operation, the results of treatment should improve.

J. R. BUCHBINDER.

IN an interesting monograph[4] Rassers reviews somewhat briefly current theories regarding the pathogenesis of gastroduodenal ulcer and then advances a hypothesis of his own. He feels that solution of the ulcer problem is intimately linked with the following questions: How does the gastric mucosa withstand autodigestion? Where and how is the hydrochloric acid formed? He accepts the following explanation for the latter question, namely, that hydrochloric acid is formed through hydrolytic dissociation of NaCl, according to the following formula:

$$NaCl + H_2O = \overset{+}{Na} + \overset{-}{Cl} + \overset{+}{H} + \overset{-}{OH} + H_2O$$

The resulting NaOH, being an alkali, makes it impossible for the pepsin to digest the gastric mucosa. Thus in the physiological process of formation of HCl nature provides at the same time a protecting agent against autodigestion.

To put the hypothesis to experimental proof Rassers fed dogs a strictly salt-free diet. After a few days of this diet, their stomach contents showed no hydrochloric acid. He then introduced daily, by means of a stomach tube, from 50 to 100 cubic centimeters of active pepsin solution. This was kept up for periods ranging from 40 to 100 days. All of the dogs showed at autopsy hæmorrhagic erosions as well as chronic ulcers of the antrum pylori or of the duodenum. What happened here, according to the author, is that the gastric mucosa deprived of the protecting influence of NaOH could not resist the digestive action of pepsin.

Rassers agrees with K. H. Bauer as to the localization of chronic ulcers along the *magenstrasse*, but does not accept his explanation that its vulnerability is due to its rudimentary character. He sees an explanation in the relative poverty of its blood supply. When as the result of some circulatory disturbance, be it neurogenic or spasmogenic, one of the end arteries in the gastric mucosa is occluded, an area of local ischæmia results. Such an area will naturally lack NaOH and will therefore not be able to resist the digestive action of pepsin; the result is an ulcer.

GEORGE HALPERIN.

[1] AN INTRODUCTITO TO THE STUDY OF X-RAYS AND RADIUM. By Hector A. Colwell, M. B. (Lond.), and Cecil P. G. Wakely, F.R.C.S. (Eng.). New York: Oxford University Press, 1926.

[2] SURGICAL ANATOMY OF THE HUMAN BODY. By John B. Deaver, M.D., Sc.D., LL.D., F.A.C.S. 2d. ed. vol. i. Phila lelphia: P. Blakiston's Son & Company, 1926.

[3] MESENTERIC VASCULAR OCCLUSION. By A. J. Cokkinis, M.B., B.S. New York: William Wood and Company, 1926.

[4] DIE PATHOGENESE DES CHRONISCHEN MAGENDARMGESCHWUERS; NEBST EINIGEN BEMERKUNGEN ZUR FRAGE EINER RATIONELLEN THERAPIE. By Dr. J. R. F. Rassers. Leyden: S. C. Van Doesburgh, 1926.

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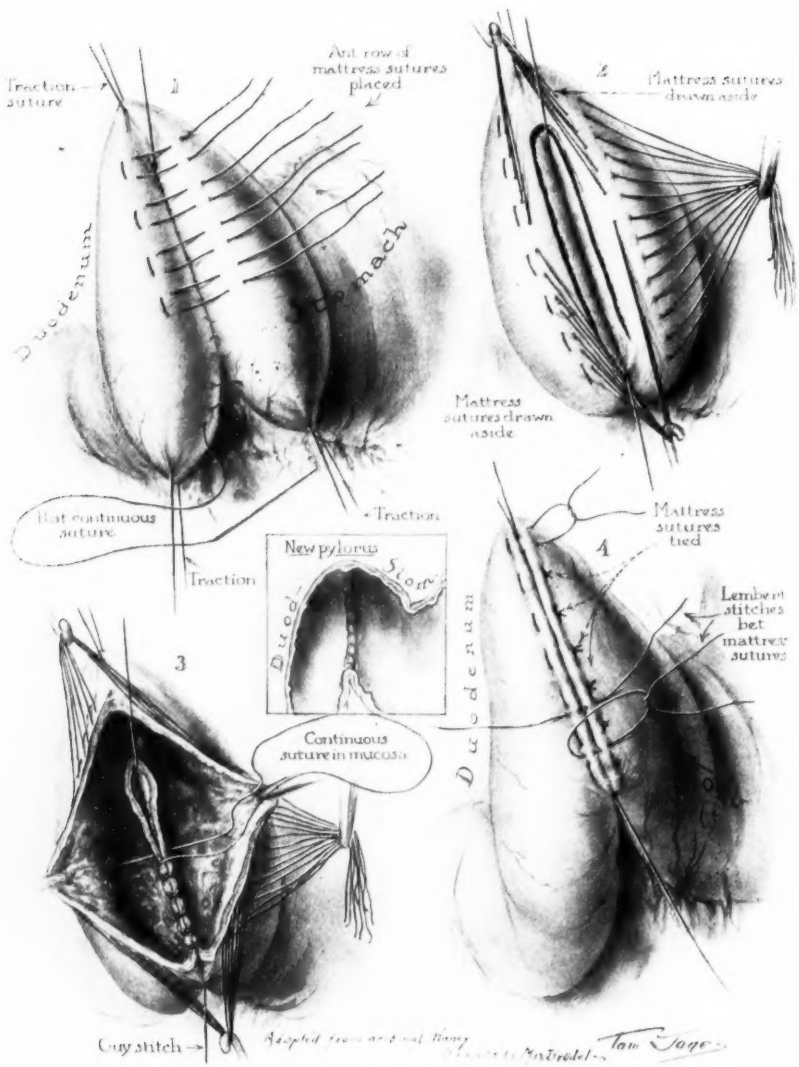

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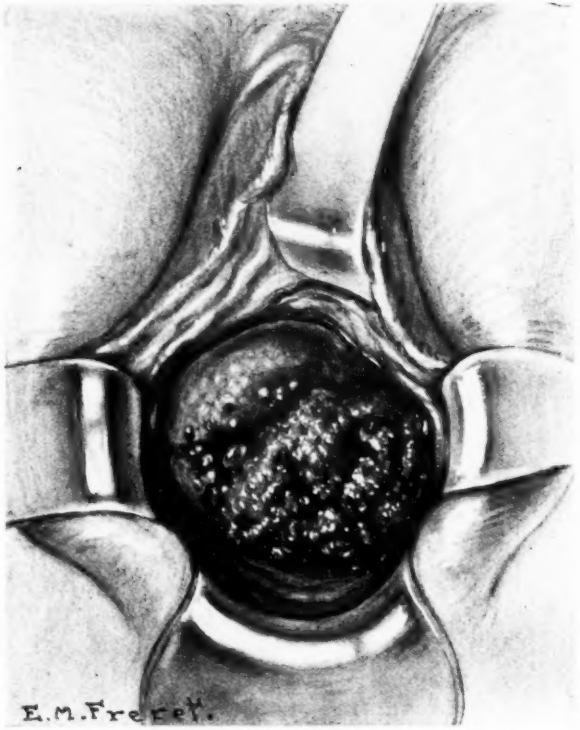

Fig. 1. (Pesmenna, No. 36740.) Cancer of the cervix before irradiation. Bilateral laceration of the cervix, cystic degeneration of the anterior lip, and cancer of the posterior lip.

Fig. 2. Cancer of the cervix 1 week after irradiation. Intense hyperæmia of the tissues.

Reaction of the Tissues to Radium in Treatment of Cancer of the Cervix.—Lillian K. P. Farrar